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ABSTRACT

This report is a guide for those who wish to acquire an understanding of the process of conducting workshops in computer-based instruction. Planning documents, handout material, visual training aids, and computer programs are contained in the report. Descriptions of five workshops are provided to indicate the nature of programs which have been held for university-level educators. The authors give strategies for workshop planning starting with long-range preplanning to actual conduct and evaluation of the workshop. The materials from the CCUC/6 Computer Conference at Texas Christian University in 1975 which are appended, illustrate typical instructional materials, leader materials, audiovisual aids, participant workbooks on computer material design for curriculum revision, and handout materials. (CH)

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THE USE OF WORKSHOPS FOR ORIENTING EDUCATORS ON COMPUTER-BASED INSTRUCTIONAL TECHNIQUES

EP-40/6/30/75

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Mark T. Muller and Agnes M. Edwards

ABSTRACT

The principle objective of this report is to serve as a guide to those who wish to acquire a comprehensive understanding and knowledge of the process of conducting workshops in computer-based instruction. Only the salient aspects relating to the major elements are covered and typical examples of an actual complete workshop are illustrated and included.

THE USE OF WORKSHOPS
FOR
ORIENTING EDUCATORS ON COMPUTER-BASED INSTRUCTIONAL TECHNIQUES

INTRODUCTION

The purpose of this report is to serve as a planning guide for those who wish to organize and present similar in-service type workshops. All relevant materials consisting of planning documents, handout material, visual training aids and computer programs are contained in this report. The objective in documenting the report (in the form of milestones) is to present only those important highlights without emphasizing the minutia typically prevalent in planning and implementing such undertakings. An overview of all workshops conducted is necessary in order to gain an insight into the use of this type of technique for educational technology training.

The overview of the five workshops indicates that three of the workshops were general in nature. Their content was not discipline-oriented, but rather was a comprehensive overview of computer-based education plus a brief "hands on" or "how to" aspect of instructional systems design. The AAAS (Mexico City) workshop, the CCUC/6 (Fort Worth, Texas) workshop and the Frontiers in Education (London, England) workshop were in this category. The two remaining workshops were discipline-oriented and were designed for the purpose of: (1) Familiarizing a group of faculty from a specialized field with the role of computer-based education and (2) Emphasizing the transfer techniques that could be accomplished by the free offer of course material from Project C-BE of The University of Texas at Austin. From each of the above workshops, lessons were learned on the basis of feedback using evaluation questionnaire forms which were completed by the participants. We found that participants: (1) Desired material to study before the workshop, (2) Expressed a need for more demonstrations and practical exercises and fewer lectures, (3) Wished to participate in small group discussions among themselves as the workshop progressed to its final phases, and (4) Wanted the name of a specific individual they could write or call for further information after the conference.

PROJECT C-BE, a jointly funded four-year National Science Foundation and University of Texas educational research project on the use of computer-based instructional techniques, has conducted a number of discipline and general orientation type workshops over the past three years. Some of the workshops have been jointly sponsored between Project C-BE and Project CONDUIT (an NSF Research Project primarily involved with transferability guidelines and standards for computer-related curriculum). The CONDUIT Project at The University of Texas is co-directed by Drs. C. H. Warlick and J. C. Browne, with Dr. George H. Culp designated the curriculum coordinator. Project C-BE co-directors are Drs. John J. Allan III and J. J. Lagowski.

AN OVERVIEW OF WORKSHOPS CONDUCTED

A total of five external workshops were conducted with the majority being held for university-level educators from off-campus and in specialized disciplines, i.e., Economics, English. The workshops were as follows:

NAME	SPONSOR Location and Date	Number of Participants
1. Use of the Computer(1) in the Conversational Mode As a Teaching Tool	AAAS/CONACYT Conf., Mexico City, Mexico June 17-22, 1973 (Dr. J.J. Lagowski)	16 (Mexican & South American Educators)
2. The Use of the Computer(2,3) in Teaching Economics	PROJECT C-BE/CONDUIT U.T. Computation Center April 26-27, 1974 (Dr. J.L. Weatherby)	16 "Economics" Faculty from Texas Colleges
3. PROJECT C-BE As An (4) Overview	Frontiers in Education I.E.E.E. London, England July 15-19, 1974 (Dr. J.J. Allan, III)	30 Workshop Conf. Participants from Europe, Africa & Asia
4. The Use of the Computer(5) in Education in the Humanities	PROJECT C-BE/CONDUIT U.T. Computation Center, October 25-26, 1974 (Dr. Susan Wittig)	30 Educators in the field of English
5. Computer-Based Education(6)	CCUC/6 Texas Christian University, Fort Worth, Texas June 16-18, 1975 (Dr. J.J. Lagowski)	55 Participants Primarily Educators

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(1) This has been published as a separate report EP-20/9/10/73, The Use of a Bilingual Workshop for Transferring the Concepts and Techniques of Computer-Based Instruction, M.T. Muller, S.J. Castleberry, G.H. Culp.

(2) PROJECT C-BE Students Guide for CAI Modules in Intermediate Macroeconomics IM-13/4/19/74, J.L. Weatherby, Jr., and J.T. Peach.

(3) PROJECT C-BE Instructors Guide for CAI Modules in Intermediate Macroeconomics IM-14/4/24/74.

(4) Implementing the Computer as an Instructional Resource, EP-30/7/1/74.

(5) English 306: An Instructor's Manual, IM-21/10/23/74.

(6) A Brief Workbook on Computer-Material Design, IM-20/6/11/75.

BRIEF DESCRIPTION OF WORKSHOPS

AAAS Workshop in Mexico City

The primary purpose of this workshop was to test the concept of transferability of university-level computer-based undergraduate teaching packages and the pedagogical strategy of their development using remote access terminals. The workshop was conducted in the period of June 17-22, 1973, with sixteen participants attending. All of the participants were from Latin American countries and had had no prior experience in the use of computer-based instructional techniques. The teaching packages consisted of bilingual modular chemistry programs.

These bilingual computer programs gave the participants the option of using either the Spanish or English version. Thus, it was much easier to present the fundamentals of instructional design for the particular modules in the appropriate language using the logic that is commonly used in each country. In the workshop, several programming languages were used which included (interactive) extended BASIC, and FORTRAN IV.

A brief evaluation form was completed by the participants. Table 1 shows the evaluation of the presentation methods. In general, the participants felt that sufficient time was devoted to oral and film presentation and writing programs. However, the majority of the participants indicated that more time should have been allotted to demonstrations and running the programs on the terminals. Suggestions for future workshops included a desire by the majority for elaboration on computer systems, terminals, and instructional computing applications. In general, the trend was toward a continuation of the type of workshop presented, with an increase in time allotted for programming. Eleven participants indicated plans to use what they had learned in the workshop in adapting computer techniques to instruction. However, a follow-up questionnaire submitted to the sixteen original participants one year after the conference yielded only one reply which was insufficient for use as valid data. For a detailed report on the workshop the reader is referred to EP-20/9/10/73, "The Use of A Bilingual Workshop for Transferring the Concepts and Techniques of Computer-Based Instruction".

TABLE 1. Evaluation of Presentation Modes

	MORE TIME	ABOUT RIGHT	LESS TIME
A. ORAL PRESENTATIONS	-	15	1
B. MOVIES	4	12	-
C. DEMONSTRATIONS	9	5	1
D. PROGRAMMING EXPERIENCE			
1. Learning the Computer Language	5	7	3
2. Writing Programs	4	10	1
3. Running Programs on Terminals	14	2	-

Economics Workshop

The purpose of this workshop was to familiarize faculty in Economics with the role of computer-based education in their discipline and to emphasize the transfer of the instructional economics modules developed by Project C-BE. Seventeen economics faculty from various universities in Texas participated in the workshop held on April 26-27, 1974 on the "Use of the Computer to Teach Economics". Dr. James L. Weatherby, the associate investigator of the economics research project and members of the Project C-BE central staff conducted the workshop. A copy of the program is shown as Table 2.

Program Title: THE USE OF THE COMPUTER IN TEACHING INTERMEDIATE MACROECONOMICS

Place: Computation Center-U.T.
Date: April 26-27

Goal: Participants will become aware of courseware available from UT-Austin for use in teaching macroeconomics.

Performance Objective	Kind of Activity	Description	Materials	Staff	Evaluation	Time
Registration		Registration desk set-up for participants	Registration Materials	Jernigan and Peach	---	1:00-1:15
1. Participants will be able to identify the roles of the following projects in developing computer-based education materials: 1) Project C-BE 2) Project CONDUIT	Individual Presentations	Project directors/personnel will give a brief overview of activities of Projects C-BE and CONDUIT	Brochures Handouts Visual aids as specified by directors	Dr. John Allan Dr. Charles Warlic or Dr. George Culp	No Evaluation	1:15-1:30
2. Participants will be able to appraise the application of the computer as an innovative instructional machine.	Narrated Slide Presentation	Brief (10 minutes) slide presentation depicting the development of modules for individual self-paced instruction, and the manner in which the computer is used for instructional purposes.	Slide presentation carrousel	Jernigan and Peach	Rating scale	1:30-1:45
3. Participants will be able to analyze the background, intent and rationale for the use of the computer in teaching macroeconomics.	Individual Presentation	Dr. James Weatherby will give a presentation which will include: 1) Initial development of modules (before Project C-BE 2) Overview of course (list modules) 3) Background-development of computer modules	Handouts Student handbook Instructor handbook Visual Aids	Dr. Jim Weatherby	Rating scale	1:45-3:00
BREAK	--	--	Coffee and cokes	---	---	3:00-3:30
4. Participants will discuss modules (7) in macroeconomics	Review of 7 modules Discussion	Presentation of seven modules Oral discussion and question and answer period	Handouts Reproduced Modules (Evaluation from designed for this presentation)	Dr. Jim Weatherby	Questionnaire	3:30-4:30
5. Participants will be exposed to the elements of cost of computer instruction	Presentation	Discussion of handouts on costs	Handouts	Eldon Reynolds Mark Muller	Rating scale Questions	4:30-5:00
6. Participants will understand transportation of computer instructed modules from the UT campus.	Presentation	Discussion of "contract" involved in transfer	Handouts Instructors' Requests Instructors' Evaluation Student Evaluation	Reynolds/Muller	Rating scale Questions	
DINNER	--	--	---	---	---	6:00-8:00
7. Participants will identify hardware needed for transfer of modules	Demonstration of	Presentation	Terminals	Eldon Reynolds	Rating scale	8:00-8:15
8. Participants will be able to evaluate effectiveness of modules by working with computer programmed materials	Demonstrations and actual working with programs on computer terminals	Participants will be given opportunity to work with all modules on the computer terminals	Terminals	Weatherby Peach	Behavioral output Questions	8:15-10:00

Table 2

Place:
Date:

Program Title: INTERMEDIATE MACROECONOMICS (page 2)

Goal:

Performance Objective	Kind of Activity	Description	Materials	Staff	Evaluation	Time
9. Participants will be able to recognize the manner in which the materials can be adapted to other courses and the problems involved.	Presentation by instructor (s) now using materials	Two presentations	Handouts as indicated	Paul Franzetti	No evaluation	9:00-9:30
BREAK	---	---	---	---	---	10:00-10:30
10. Participants will be able to appraise methods of evaluating computer instruction courseware as used in macroeconomics.	Review of Evaluation Procedures	Handouts--Evaluation of Macroeconomics--designed by Svinicki	Handouts--Evaluation of Macroeconomics--designed by Svinicki	Dr. Marilla Svinicki	Rating scale	
11. Participants will participate in a discussion period during which there will be a critique of the courseware developed.	Questions and answers Discussion	---	---	---	---	
12. Evaluation of workshop			---	---	---	11:45-12:00

Prepared by: MTM
2/28/74 JJ

Table 2 (continued)

The overall evaluation of Dr. Weatherby's Economics Workshop was a very positive one. Seventeen participants completed the evaluation questionnaire. Ratings were made on a five point scale, with one being the most favorable rating and five the least favorable. The most highly rated aspect of the workshop was the trying out of the modules, which was described as very interesting and informative ($\overline{X}$ = 1.12). Several participants expressed the desire to have more time to try modules on the computer. Participants were also enthusiastic about the slide modules ($\overline{X}$ = 1.50) and about Dr. Weatherby's discussion on writing modules ($\overline{X}$ = 1.32). Participants were more critical of the discussion regarding cost of implementation, saying that it was not as clearly explained as it could have been ($\overline{X}$ = 2.71). Suggestions were made to define some of the technical terms and to use a less heavy "jargon." The explanations of method evaluation were also rated somewhat lower than the rest of the workshop ($\overline{X}$ = 2.141). When asked to rate the overall workshop in terms of interest level, clarity, and organization, those attending gave it an average rating of 1.35 on a five point scale.

Fifteen of the seventeen respondents left the workshop willing to try CAI in their own economics classes. Eleven of the fifteen were at least considering using the modules presented at the workshop, while eight of these said they were definitely planning on it.

The major change in this workshop, compared to the earlier Mexico City workshop, was at the conclusion of the lectures and demonstrations. A panel discussion was held in the conference room of the computation center to provide for greater personal involvement of the participants.

One very interesting result of organizing and conducting the Economics Workshop was that Dr. Weatherby, the associate investigator who conducted the major part of the instruction, was provided with a powerful incentive for the completion of all of his documentation in transferable complete packages. Such packages of course had to be in formats that could be understood and used by the peer groups present. It was at this stage that the associate investigator really understood the point of completeness of all elements of instructional design. This point was forcibly brought home — upon the discovery at the planning stage that an instructor or student manual was required and had to be written, as well as thorough educational and technical documentation of each module.

Frontiers in Education Workshop

Project C-BE personnel presented a program at the Frontiers of Education International Conference in London jointly sponsored by the American Institute of Electrical and Electronic Engineers and the British Institute of Radio and Electronics in London, England on July 16, 1974. The two hour presentation consisted of three programs: A thirty-minute lecture covering an overview of Project C-BE; A one-hour discussion and panel session; and a thirty-minute on-line demonstration of a sample chemical engineering simulation program. A total of thirty people (many from foreign countries) attended all three of the sessions. A questionnaire form was completed by the participants which included their address, areas of interest in instructional computing, and specific information they required from Project C-BE. Of the thirty persons attending, eighteen were highly experienced on the use of computers in education, six had a limited degree of experience and six had no knowledge of the use of computers in education. The film slide presentation was well received, but due to computer and communication restrictions the "hands on" session was limited to demonstrating only one program which operated successfully.

English Composition Workshop

The purpose of this workshop was to familiarize faculty members with the use of computer-based education in teaching English composition and to facilitate the transfer of english modules developed by Dr. Susan Wittig. The workshop was jointly conducted by Project C-BE/CONDUIT and held in the University Computation Center on October 25th and 26th, 1974. A total of thirty persons, comprised mainly of English faculty from Texas universities and colleges, were invited to attend. An overview of the workshop is given in Table 3. This workshop allowed participants as much time as possible for "hands on" demonstrations of the computer

Program Title: THE USE OF THE COMPUTER IN EDUCATION IN THE HUMANITIES

Place: Computation Center
Date: 10/25-26/74

Goal: To demonstrate the use of computer in teaching English composition (Tentative Planning Sheet)

Performance Objective	Kind of Activity	Description	Materials	Staff	Evaluation	Time
Overview of the workshop	Presentation Slide Presentation	Jernigan and Culp	Slide Presentation on English Course--PROJECT C-BE	Jernigan, Culp	To be designed similar to other workshop evaluations	1:15-1:30
Participants will be able to identify the role of the following projects in the process of adapting the computer for instructional purposes: a) Project CONDUIT b) PROJECT C-BE	Allan Warlick (or Culp)					1:30-1:45
Participants will be able to appraise the necessity for designing	Presentation	Dr. James Stice - Personalizing Instruction Dr. Stanley Werbow--Introduction of of Work with Computers in Humanities				1:45-2:30
COFFEE BREAK	---	---	---	---	---	2:30-2:45
Participants will be able to analyze the rationale for using the computer to teach English Composition		Dr. Susan Wittig a) Description of overall design of entire course. b) Use of computer in course Display of module on CRT screen	Large screen in Computation Center, Room 8	Wittig		2:45-4:30
Evening Session						
Participants will be able to evaluate effectiveness of modules by working with computer programmed materials	Individual operation of modules on terminals	"Hands on" exercises with computers	Terminals--Room 210 ENL	Muller Culp Jernigan		8:00-9:30
Saturday, October 26						
Presentations on: Hardware Evaluation Design Costs Transfer of Courseware	Presentations	Hardware--Muller Evaluation--Wittig Costs-- Reynolds Transfer--Jernigan/Culp		Muller Wittig Reynolds Jernigan/Culp		9:00-10:30
Group Discussions		2-3 persons will be given sets of questions to answer, (or further questions to generate), regarding possible application of C-BE materials in their colleges or universities. Large group.				10:30-11:30

Table 3

modules on CRT (Cathode Ray Tube) terminals. "Proctor" personnel were present to explain the material and to answer questions. In addition, there was a final review consisting of a question and answer session to summarize and assist participants. The responses obtained by the evaluation questionnaire indicated that faculty participants had a favorable attitude toward using the computer for teaching English. The results of the evaluation of the workshop itself indicated a favorable opinion--on a five point scale with one as the most favorable score, the average response was 1.35. Many transfers resulted from this workshop, including the University of Texas at San Antonio, San Antonio Junior College, and other institutions.

CCUC/6 Workshop

In an effort to assess the aspects of transfer knowledge of computer-based instructional techniques, particularly with reference to the instructional design process itself, personnel from Project C-BE organized and conducted a unique type of workshop for educators attending the Computer Conference in Undergraduate Curriculum Number 6 (CCUC/6) hosted by Texas Christian University, Fort Worth, Texas, June 16-18, 1975 with financial support from the National Science Foundation. The workshop program comprised a two-hour session (1:30 to 3:30 pm on June 18th) which proved to be too limited. Overall, the workshop appeared to have the proper "mix" and organization; and based on feedback from participants it was highly successful.

The distinctive feature of this workshop was the organization of the program itself. It consisted of an introductory lecture on the topic "Computers in Education." This was of thirty-minutes duration. During the remainder of the time, conferees actively participated in a systematic approach to curriculum design and the planning of a computer-based educational module. Figure 1 gives an overview of the workshop structure. After the introductory lecture participants worked for thirty minutes in five small groups of eight to ten persons headed by a discussion leader from Project C-BE on the analysis of a given course. The course analyses were then compared and a specific module lending itself to computer-based education was selected. Each group was then designing the module. The results were again compared and an

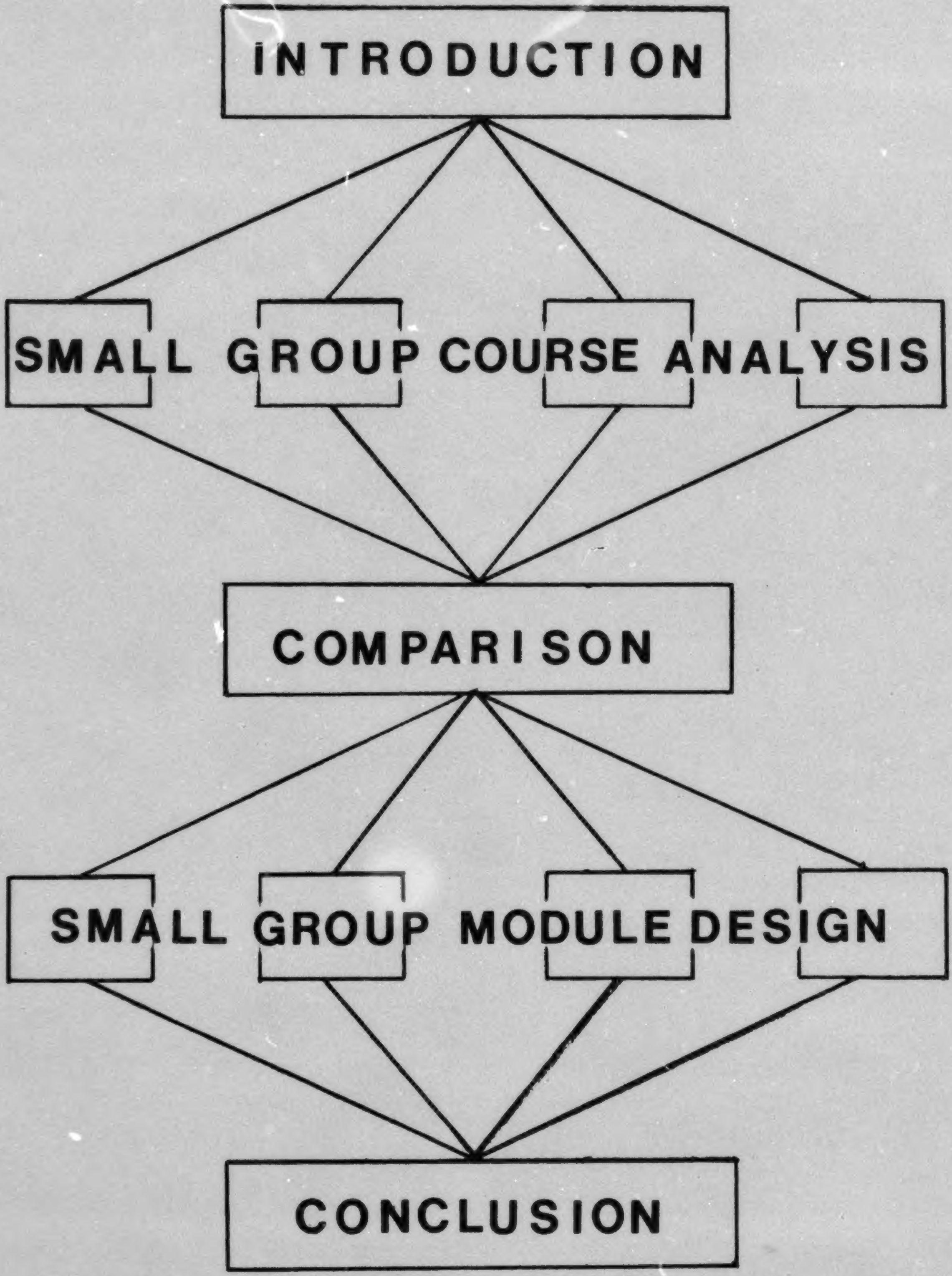


FIGURE 1

CCUC/6 Workshop Structure

example module was available on the computer for "hands on" experience. The CCUC/6 workshop actively involved the participants in the systems approach to instructional design, illustrating the methodology involved in designing computer-based education. The vehicle selected was a familiar topic: "You and Your Car." For demonstration purposes a trouble-shooting modules was developed. It describes an emergency stopping of a running car. The student must determine the cause of the trouble through finite process of elimination. The entire exercise has been "flowcharted" and programmed to run on a minicomputer using Data General extended BASIC on a NOVA 840 time-sharing terminal.

THE STRATEGY OF PLANNING WORKSHOPS ON COMPUTER-BASED INSTRUCTION

The planning of a workshop can (if not properly organized, budgeted and implemented) be a costly, time-consuming and difficult task to the neophyte, which could end in failure. The major resources required are the five "M's": Manpower, Material, Money, Meshing (scheduling of events) and Methodology. These must be spelled out in the form of a broad requirement statement as early as possible, with formal commitments and/or agreements stated wherever possible in writing. The process used by the Project C-BE staff is that of a systems approach used by engineers, a defining of the program in terms of who will do what, where, how, why, when, and at what cost! To be more specific a program planning form is shown in Tables 2 and 3. This is the type of form used for workshops by Project C-BE. The form lists: The program title, place and time, and the goal of the workshop, as well as objectives, kind of activities, description of the activities, materials, staff support required, method of evaluation and time of presentation. The most difficult part of the planning process is integrating the instruction and pedagogy to produce the desired goals without unduly subjecting the participants to excessive lengths of time for lectures or without presenting demonstrations that are too long or complex to accomplish the purpose in mind. It is during this planning process that one has to keep an eye on costs and be realistic in the estimates; otherwise costs can go far beyond the budgeted resources and produce a very embarrassing, humiliating and difficult problem for everyone. Perhaps the most important element of all in planning workshops is to assure as much active involvement of the participant in the learning process as possible. Great stress and use should be made of several group and individual self-paced teaching sessions in the form of practical exercises of short duration to produce the desired results.

Pre-workshop planning normally has five phases which are time-dependent and not necessarily sequential, but highly interrelated and require good recordkeeping for confirmation, follow-up and scheduling arrangements. The five phases are described below:

PHASE I

Long-range pre-planning period. This may vary from two years to as little as six months ahead of the workshop. A phasing chart as shown in Table 4 allows for an easy overview of the various tasks involved in workshop planning. At this time, broad objectives and requirements are firmed up, consisting of the following:

1. Name of Conference
2. Date of Conference
3. Location
4. Sponsor(s)
5. Overall goal of Workshop
6. Type & Number of Participants
7. Budgetary Support
8. Conference Planning Committee
9. Advance Publicity Printing and Mailing
10. Administrative Support and Mail Handling Procedures for Registration
11. Submission of Papers (If required)

Since Project C-BE workshops were of a smaller size, in general, restricted to between thirty and forty participants, the scope of effort was limited. Thus, the pre-planning sessions were normally handled by a two- or three-person committee consisting of sponsor(s) and those principals who were to conduct the workshop. Normally, two committee meetings were held before the workshop (each, one month apart) to firm up preliminary plans for the presentation. To assist us, a large master planning sheet for the program was used to formalize the objectives and subjects to be presented, plus any associated information required. Since the finances required to support such workshops normally came from The University of Texas (either from Project C-BE or other projects), the allocation of funds was a straightforward estimating process.

Since there are so many variables which enter into the cost of planning a workshop which are dependent upon the number of days, the number of participants and the type of workshop the sample budget is shown in Table 5

(NAME) WORKSHOP PHASING CHART DATE

Prepared by__________ Date__________

Event / Time Phasing	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.
Prepare Broad Goals & Objectives	XXXXXXXXX						
Prepare Budget and Support Plan	XXXXXXXXX						
Mail Out Advance Notice of Workshop		XXXXXXXXX					
Arrangements Workshop Facilities			XXXXXXXXX				
Lodging and Meal Arrangements			XXXXXXXXX				
Computer & Communications Coordination		XXXXXXXXX					
Prepare Workshop Instructional Materials			XXXXXXXXXX	XXXXXXXXX			
Load & Check Out Computer Programs				XXXXXXXXX	XXXXXXXXXX		
Reproduce Workbooks, Eval. Forms, Handouts, Etc.					XXXXXXXXXX		
Mail Out Letters To Participants					XXXXXXXXXX		
Print Signs, Name Tags, Etc.						XXXXXXXXX	
Rehearsal For Workshop						XXXXX	
Present Workshop							XX
Evaluation of Workshop							XX
Report on Workshop							XX
Follow Up Letter							XX
Transfer of Programs							XX

TABLE 4

Sample Workshop Format For Budget Date 19

PROJECT (Name of Project)

		Basic Costs	Participant Expenses
Honoraria:			
Smith:	$137.20		
Jones:	300.00		
Total Honoraria		$437.20	
Lodging and meals for participants		. . . .	$571.75
Travel for participants		. . . .	907.50
Van Lease (from University to Motel)		. . . .	43.55
Project Staff time - 50 - person hours		375.00	
Terminal Time (TM & LN)		20.92	
Printing Costs (Evaluation Questionnaire)		7.50	
TOTALS --		840.62	1,522.80
DEVELOPMENT COSTS			
Development Time:			
Educational Technologist 120 person hrs.		1,200.00	
Curriculum Specialist 120 person hrs. (average $10.00 per hour)		1,200.00	
Printed Materials for Student and Instructor handbooks 80 pages each--100 copies			
Typing costs--32 hours @ $3.20 per hour. . .	$112.00		
Duplication, paper, mats, collating . . .	120.00		
	$232.00 . . .	464.00 (200 copies)	
Slide Preparation Costs		110.49	
		2,974.49	
Total Cost of Workshop		$ 3,815.11	$1,522.80
Total Cost			$5,337.91

Table 5

only as an example. It may be incomplete for large-scale workshops and is intended only as a guide.

PHASE II

Once the overall goals and parameters of the workshop have been established, the actual planning and development stage of the workshop begins. This phase involves the following tasks:

1. Specification of the workshop objectives
2. Planning of workshop activities and evaluation
3. Development of the necessary media
4. Assignments, duties and responsibilities to personnel
5. Assignment of personnel to the various tasks
6. Planning of logistics and maintenance support
7. Arrangement for use of facilities
8. Planning for exhibits (if required).

The details of the workshop are spelled out on the program planning form, and the materials for the individual sections are designed and developed. The media selected and used during a workshop will do much to improve a presentation and prevent audience boredom. Such aids, when used, should be selected with care to emphasize or illustrate only specific points. The technical quality of a slide, for example, if it contains printed matter, should be large enough in size to be readable from the rear of the room. The use of color in visuals will enliven a presentation and make it easier for the audience to follow. Such visuals must be carefully planned well in advance of the workshop and must be designed to match the speakers pace and tempo during the talk. There is one caution in the use of handout materials of a printed nature, and that is it is better not to place such materials in the user's hands during the lecture as it may become a distractor. The use of a series of slides to describe a process (or steps) is best accomplished prior to the issuance of the handouts. Handouts are best distributed at the end of the session.

That portion of holding a workshop relating to logistics support and maintenance of equipment is the one area that is likely to prove most difficult to control. While the sage advice of producing something well in advance, i.e., handouts, transparencies, programs, etc., seems simple enough, in actual practice it is just the opposite for the following reasons: Too often a planner will take for granted that a task is completed based upon issuance of a workorder, a verbal request or a telephone response. It is recommended one make a checklist; and as the material is received, record it. If at all possible, affix responsibility to one person for seeing that the material is on hand at the right place and right time for use. "Dry runs" (rehearsals) will quickly show if anything is missing for a presentation. With regard to maintenance, it is well to have available a spare projector bulb or standby unit itself as well as the information on how to summon a technician in case all else fails.

In selecting facilities, the comfort and ease of use factor for the workshop participants is perhaps the most important element to bear in mind. For small group exercises, library tables for two to four persons have proved most efficient for communicating, and lend an air of informality to the session. Such sessions provide for a maximum interchange of information and understanding. At lease one or more proctors should be close by to render assistance if needed.

PHASE III

These are the procedures immediately prior to the workshop:

1. Lodging arrangements for participants.
2. Transportation arrangements from motel or lodging.
3. Preparation of printed materials in form of programs, brochures, name tags, registration forms, etc., for use at conference.
4. Confirmation letters to each participant containing conference information on lodging, travel, building location of conference and programs.
5. Rehearsal of the presentation for all instructors and support personnel with check-out of equipment, telephone lines and computer programs: Checking of visuals for completion and timing with any synchronized script.
6. Discussion of anticipated questions.

PHASE IV

This is the actual conduct of the workshop.

The directions to participants to reach the workshop should be posted by conspicuous signs in appropriate places.

A registration table and sign-in sheet should be used for "logging in" participants. At that time a complete packet of workshop materials, name tag, and relevant information personally presented to each participant.

The session should start on the time indicated and adhere as closely as possible to the period allotted for each session.

Each speaker should announce that questions may be asked during the session or conversely at the end of each presentation if pressed for time.

The sponsor or chairperson should briefly state the purpose of the conference, introduce the instructor and support personnel, cover important administrative announcements and state where emergency messages may be received and posted. The use of workshop evaluation questionnaires should be explained to the participants on the basis of improving future workshops.

During the workshop coffee breaks informally mix and communicate with the participants to get their pulse and attitudes. Stimulate interest by responding to questions with factual information and not opinions where possible.

Announce that participants in filling out evaluation forms do not have to sign their name if they do not wish to do so.

PHASE V

Collect completed evaluation forms and analyze data. Prepare a report.

Send a copy of report to participants with a follow-up letter (if desired) at a later date to ascertain whether or not the workshop knowledge and programs were put to use in their present duties.

Summary and Recommendations

In conducting the five C-BE workshops, it became apparent that there were two important variables that contributed to the success of a workshop:

1. Active involvement of the participants.
2. The use of non-technical terminology.

Participants preferred more actual "hands-on" experience during the sessions than the lecture presentations. One common criticism of the lecture-type sessions was the "heavily oriented technical" jargon that was used especially in the computer system and fiscal areas. The small work group model used at the CCUC/6 workshop would be well suited to work with participants with varied computer backgrounds. Persons with common levels of computer sophistication could be assigned to the same group, thus affording them an opportunity to talk about more technical details while the novices in the field could discuss the same subject matter in a less technical manner.

As to the content of the workshop presentations and the computer-based materials used. It was found that materials had to be well documented to answer the questions asked by interested participants. The C-BE transferability guidelines (Appendix A) served as a useful instrument in preparing the materials for workshop presentations. Especially for the two discipline oriented workshops which had as their primary goal the transfer of the computer-based materials. Thorough documentation should include educational as well as technical descriptive matter.

Recommendations for Future Workshops

The early Dutch settlers in New York State had a saying, "We grow to old smart". While each workshop allowed for the removal of any remaining rough edges, it also provided the planners with more experience to apply to future workshops. It is our considered opinion that one should not use the term workshop for any session shorter than at least half a day. A one-day workshop would allow for more flexibility in adjusting to the participants ability to assimilate the knowledge and accomplish the exercises. The length of any workshop is, of course, contingent upon many factors and in covering the computer-based workshop we have focused upon the small (30 to 40 person) size workshop. A suggested format and program is shown in Table 6.

TABLE 6. Schedule of Activities

EVERYONE	I	Introduction to Course Design	
		Explanation of Workshop Format	1/2 hour or more
SMALL GROUPS	II	Course Analysis	
		Goals & Objectives	
		Hierarchy	
		Modular Structure	
		Task Analysis	1 - 1 1/2 hour or more
		Media Suggestion	

First a group decision on the topic, then demonstrate prepared solution.

LARGE GROUP	III	Recap & Summary of Processes Just	
		Completed, Relate to Introduction	1/2 hour or more
		Discuss Module Design	
SMALL GROUP	IV	Module Design	
		Response Specification	
		Flow	1 hour or more
		Sample Interaction	
LARGE GROUP	V	Comparison of Developed Programs	
		Compare with Prepared Program	1/2 hour or more
		Recap on Process	

In order to illustrate specifically the improvements incorporated into the later workshops the next section contains the CCUC/6 workshop papers held at Texas Christian University on June 18 reproduced in full.

APPENDIX A

A. Catalogue Information

1. Title of Course
2. Author(s)
3. Abstract of Course Material
4. Source and Availability Information
5. Date of Issuance
6. Computer Operating System and Programming Language Information
7. Target Audience (Description of Intended Use)
8. Technical Papers or Reference Material

B. Educational Information

1. Educational Objectives.

   What does the instructional material teach? What is the student expected to learn from the material? Overall general objectives may elicit interest from potential users. However, specific objectives are necessary to enable a user to incorporate the instructional material into a given course.

2. Evaluation Criteria.

   What processes or methods are used to evaluate student success?

3. Description of the Course Materials.

   A short abstract of each module makes it possible for potential users to select individual modules if they so desire.

4. Student Prerequisite Skills.

   A short description of the target population for which the modules were written. What skills are necessary to successfully complete the modules?

5. Instructor Orientation Information.

   An Instructor's Handbook to facilitate the use of materials. Guidelines and suggestions for potential users.

6. Technical Papers, Publications, and Reports about the Material.

   Evaluation Results. Documentation of the program.

7. Time Phasing.

   What is the average time required to complete each module?

8. Cost Data.

   What is the initial cost of the program, the implementation cost, the cost expressed in dollars per student terminal hour? What are the indirect costs concerning supplies, maintenance, administration, hardware, communication, miscellaneous, etc.? How cost effective is the material?

C. Technical Information

1. Technical Transportation Documentation.

Contains computer program documentation consistent with recognized guidelines such as "Standards for CACHE FORTRAN Computer Programs" or guidelines for other languages. All non-standard programming should be flagged.

2. Computer Operating System Information.

Any system-dependent functions must be fully documented to permit duplication on a new system. Terminal requirements and transfer media specifications must be clearly defined in standard data processing terminology.

PROJECT C-BE WORKSHOP
CONDUCTED AT THE
CCUC/6 COMPUTER CONFERENCE AT
TEXAS CHRISTIAN UNIVERSITY

FORT WORTH, TEXAS
June 18, 1975

PROJECT C-BE WORKSHOP
CONDUCTED AT THE
CCUC/6 COMPUTER CONFERENCE AT
TEXAS CHRISTIAN UNIVERSITY
FORT WORTH, TEXAS
June 18, 1975

ABSTRACT

The Project C-BE workshop conducted at the CCUC/6 Computer Conference in Fort Worth, Texas on June 18, 1975 is reproduced in its entirety with some modifications in this portion of the publication to illustrate all of the instructor materials, audio-visual aids, participant workbooks and hand-out materials. Within each section appropriate remarks have been superimposed in an informal style to identify where and how the material was used in the presentation.

INSTRUCTIONAL MATERIALS

In order to clearly illustrate the type of prepared instructional materials used in a typical workshop, four separate categories are attached as follows:

Workshop Leader

This is a packet developed for the workshop leader. It consists of:

1. Overall schema narrative.
2. "Masters" for making overhead transparencies illustrating how the workshop will be conducted; and the steps in instructional design.
3. A narrative introduction to instructional design.
4. Instructions in the form of goals and objectives for each portion of the workshop.

Group Leader

This packet is for the individual group leaders. It contains:

1. Instructions on how to conduct the small group sessions.
2. Overhead transparency blanks.
3. One transparency marking pen.
4. Four handouts for use by participants.
5. The Worbook on Computer Material Design.

Participants

This packet is designed for the individual workshop participant. It contains the following items:

1. General workshop overview.
2. The problem: You and Your Car.
3. The Workbook on Computer Material Design
4. Workshop Evaluation Questionnaire.

Packet on Module Documentation

This packet contains the following items which are the solution to the problem in the form of:

1. The problem solution with a series of multi-path acceptable inputs from A through N.
2. Overhead transparency masters for illustrating solutions of paths A through N.
3. A module flowchart diagram.
4. Source listing of BASIC Program
5. Terminal output. A copy participant would see while on teletypewriter.

In order to conduct this workshop, the following facilities and equipments are needed for approximately forty participants. This is only a suggested guide.

Facilities. A one-classroom of a size to hold fifty people (including instructor personnel). Five group discussion workspace areas consisting of library tables arranged to hold eight persons per group with a total of five groups in all.

Audio-Visual Aids. Two Overhead Projectors. Transparencies (10" x 10" acetate). Transparency Marking Pens.

Equipment. Four Model KSR-33 teletypewriter terminals, each terminal hooked up to an acoustic coupler type of data set through a dial up (or touchtone) type telephone line linked to a NOVA 840 time-sharing system. This equipment will be used for programming and on live demonstrations by the participants.

PACKET FOR WORKSHOP LEADER

PACKET FOR WORKSHOP LEADER

This packet should contain

1. PROJECT C-BE Workshop overview with transparency
2. Implementing the Computer as an Instructional Resource
3. Instructions for Part I, II, and III of the Workshop.
4. Sample transparencies
5. A Brief Workbook On Computer Material Design.

PROJECT C-BE WORKSHOP

Instead of having a formal lecture on the process of computer material design, we felt it would be more interesting if the entire group embarked on a simulated course design. Therefore, the workshop this afternoon will follow this outline:

I. A brief overview "Implementing the Computer as an Instructional Resource", introduction to the workshop proceedings.

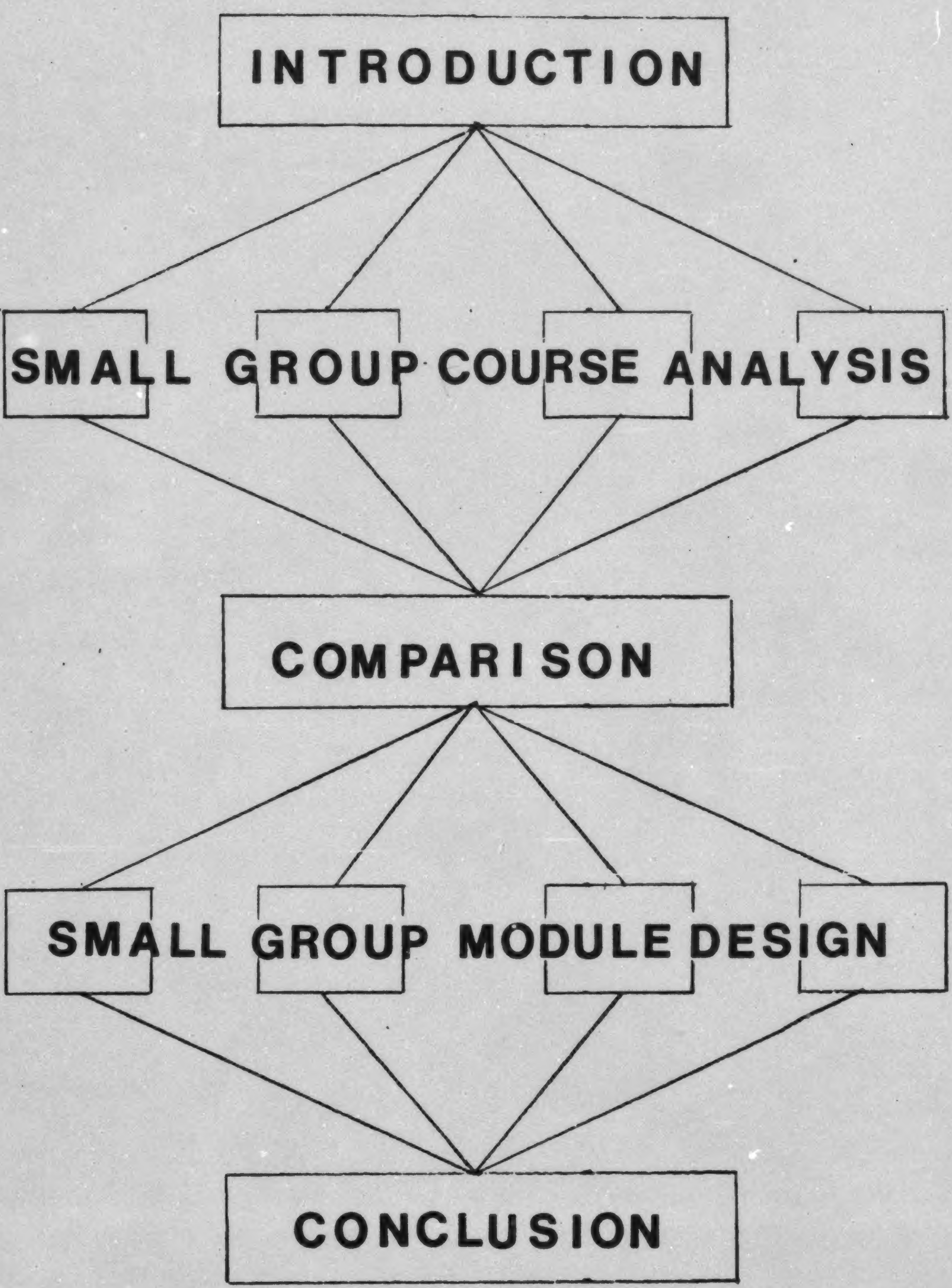
II. The large group will divide into several small groups and do a course analysis using the fictitious course provided by the workshop leaders.

III. The large group will reconvene to compare the course structures which were developed in the previous section.

IV. Taking one module from the course, the small groups will meet again to design a computer program to fit the needs of the module.

V. The large group will meet to compare the programs they have developed and discuss in general the process of program design.

In this process of give and take, we hope we will learn from each other and thus derive the most from the workshop.


INTRODUCTION
SMALL GROUP COURSE ANALYSIS
COMPARISON
SMALL GROUP MODULE DESIGN
CONCLUSION

PART I OF WORKSHOP: A Brief Overview

Implementing the Computer as an Instructional Resource
Prepared by Project C-BE

Today's information explosion, the growing student population, the emphasis on accountability, and individualized education, are challenging educators to implement more effective and efficient instructional systems. Institutions are turning more and more to technology to meet their needs. Computer-Based techniques not only offer great potential in facilitating administrative tasks, but also in serving as unique instructional media. The following presentation discusses a systematic approach to system change in education with emphasis on computer-based techniques.

Once the decision to effect a change in traditional procedures has been made, it is imperative that the change be addressed pragmatically and thoughtfully. Institutions can and have spent large sums on what later proved to be a less efficient instructional system when a more thorough investigation of the problem would have uncovered a far better solution for less cost.

A systematic approach to change in education would begin with a study of the current situation. This study would include:

1. A statement of the goals and objectives of the program.
2. An analysis of the current materials and technologies used at the local institution.
3. Identification of which goals the current system fails to achieve.
4. An estimate of the costs of instruction and the results obtained.

Most important in the above list, however, is the statement of objectives which generates specifications for the end product and provides the criterion for evaluation of alternative systems.

Once the state of the art extant in current systems, instruction and hardware, has been thoroughly analyzed, the next step is to review and consider the results achieved in systems at other institutions. Finally, a search through the literature, attendance at national conferences, and personal contacts should result in a fairly comprehensive list of possible solutions. These solutions would then be examined in terms of what is feasible for the user institution. Generally, three alternatives would present themselves:

1. A perfectly compatible and ideally suited instructional system is located and transferred directly to the user institution without modification.
2. A reasonably suitable system is available which, with some modification, can be implemented at the user institution.
3. No suitable, externally developed system is feasible, and the user institution is faced with the task of developing its own instructional system.

This last alternative is where most institutions now find themselves, not because similar instructional tasks have not been accomplished, but because the systems in use are not readily transferable. This lack of readily transferable materials has cost a great deal of money because of the repeated development of unique systems at each institution, none of which has made a significant impact on the national need. Computer-based education is a dramatic example of this problem.

Project C-BE, the computer-based education project at The University of Texas, has been funded by the National Science Foundation to study the computer as an instructional resource. One of the goals of the project is to suggest guidelines for the development of computer-based materials.

Computer-Applications Development

Our philosophy is to use computers to supplement, not replace, existing instructional systems. To design a course in which computers may be used, one must conceive of the course material in terms of a series of individual lessons (modules), some of which may be implemented more effectively by a computer. With this scheme in mind, the following are steps to develop functional, transferable, computer-based instructional materials:

Intent and Rationale.

State the rationale for the instructional materials, including a needs assessment, consideration of past and proposed efforts to meet those needs, an outline of the proposed development of the materials, and a cost estimate.

Design: Analysis.

Assess prerequisites, conduct a task analysis and state terminal behavioral objectives. This assessment also includes an analysis of learner traits, an analysis of media and equipment, and a comparison of the cost of various media.

Design: Synthesis.

Design learning activities, including provisions for individualization, pre- and post-tests, suitable media, and instructional material.

Production.

Produce, pilot test, edit, and revise the instructional materials.

Evaluation.

Assess the teaching success of the instructional materials. This includes an external empirical evaluation of the validity and efficiency of the materials, an internal evaluation of construct validity, and an evaluation of criterion test reliability.

Dissemination.

Distribute only instructional materials which meet specifications enabling other universities or other departments to utilize the products.

These basic steps compose a dynamic process including several cycles for refinement, as indicated by Figure 1. This workshop will go through the steps involved in design analysis and design synthesis.

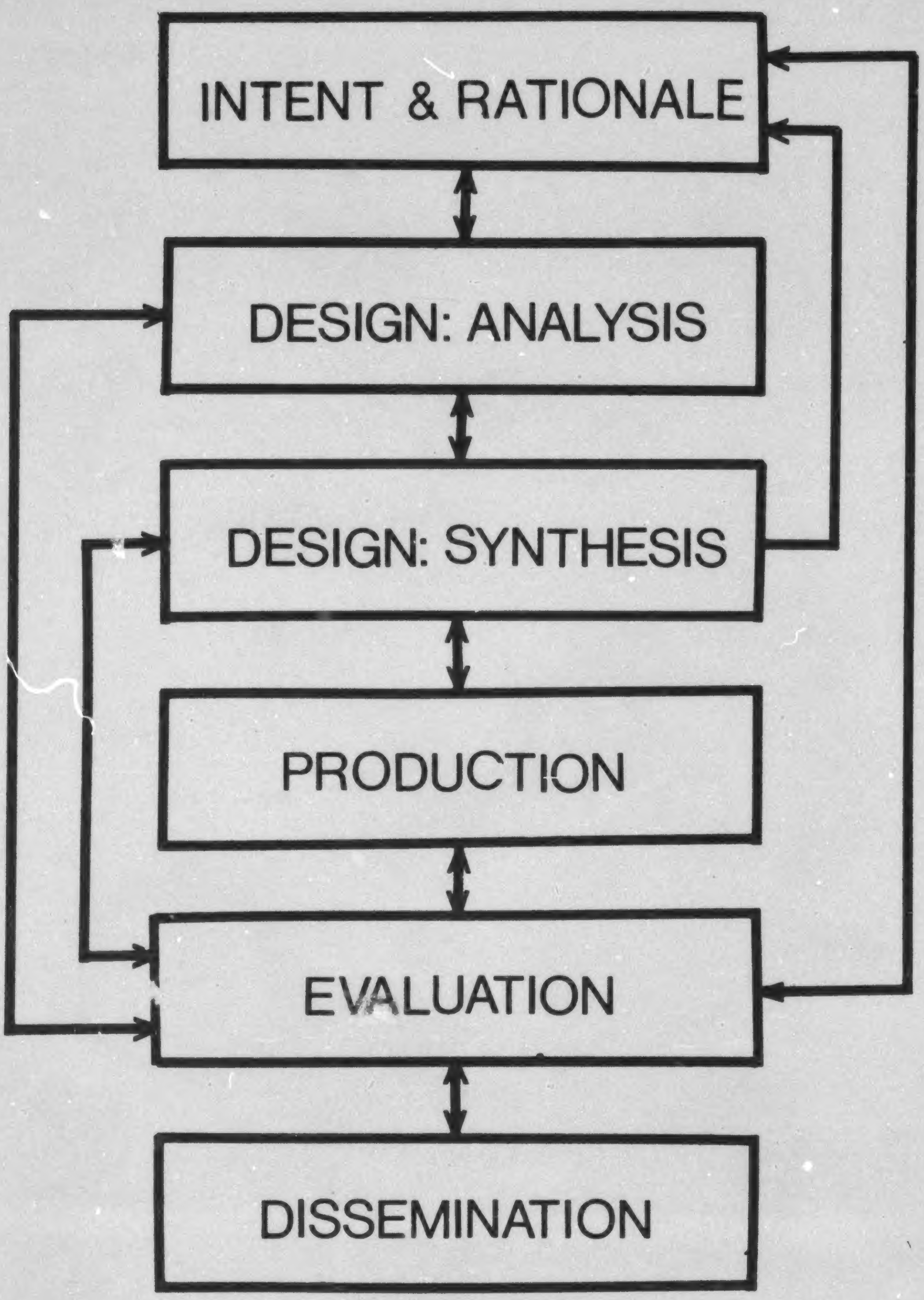

INTENT & RATIONALE
DESIGN: ANALYSIS
DESIGN: SYNTHESIS
PRODUCTION
EVALUATION
DISSEMINATION

FIGURE 1.

* * * * * * * *

(Divide participants into small groups and outline the group tasks briefly. Each participant will have a copy of the premises and a workbook in his folder.)

Part III of Workshop: Compare the goals and objectives of the groups. Point out commonalities. Use two overhead projectors for simultaneous displays. If necessary, use the sample goals and objectives transparencies.

At the end of this large group session, you should have selected a common module on "trouble shooting" to be designed during the next small group session.

Part V of Workshop: During this session you should discuss the modules developed by the various groups and introduce and describe the simulation module with subsequent hands on experience on computer terminals.
(Use transparencies of module flowcharts, excerpts of author's draft and print-outs.)

GOALS:

THE STUDENT WILL KNOW THE PARTS OF THE CAR AND ITS SUBSYSTEMS.

THE STUDENT WILL UNDERSTAND THE FUNCTION OF THE MAJOR CAR SYSTEMS AND THEIR COMPONENTS.

THE STUDENT WILL BE AWARE OF WHAT IS NECESSARY TO MAINTAIN THE CAR IN GOOD RUNNING CONDITION AND BE ABLE TO DO SO.

THE STUDENT WILL BE AWARE OF THE PRIMARY DESIRABLE CHARACTERISTICS IN A CAR GIVEN A VARIETY OF CONDITIONS.

THE STUDENT WILL UNDERSTAND THE LEGAL ASPECTS OF CAR OWNERSHIP.

GOAL:

THE STUDENT WILL KNOW THE PARTS OF THE CAR AND ITS SUBSYSTEMS

OBJECTIVES:

1. TO IDENTIFY IN A DIAGRAM OR REAL LIFE THE MAJOR PARTS OF THE AUTOMOBILE AND MAJOR SUB-COMPONENTS OF THE SYSTEM SUCH AS AIR FILTER, SPARK PLUGS, ETC.

2. TO LOCATE THE MAJOR COMPONENTS OF A CAR WHEN GIVEN A REAL CAR.

GOAL:

THE STUDENT WILL BE AWARE OF WHAT IS NECESSARY TO MAINTAIN THE CAR IN GOOD RUNNING CONDITION AND BE ABLE TO DO SO.

OBJECTIVES:

1. TO DESCRIBE THE MAJOR TYPES AND TIMING OF ROUTINE MAINTENANCE SUCH AS OIL CHANGE, LUBRICATION, TIRE ROTATION, PLUGS AND POINTS CHANGE, ETC.

2. TO PERFORM ROUTINE MAINTENANCE WORK ON A CAR.

3. TO DIAGNOSE THE POSSIBLE CAUSE AND RECOMMEND A SOLUTION IN A GIVEN PROBLEM SITUATION.

PACKET FOR GROUP LEADER

PACKET FOR GROUP LEADER

This packet should contain

1. Instructions for group sessions

2. Transparency blanks (4 to 6)

3. One transparency marking pen

4. Four handouts: Worksheet #1
   Worksheet #2
   Hierarchical Structure
   Modular Structure

   (10 to 12 copies each)

5. A Brief Workbook On Computer Material Design.

WHAT TO DO IN THE WORKSHOP SESSIONS WITH YOUR GROUP

Group Leader Instructions

At the end of the first small group session, your group should have developed:

1. A set of goals--write them on a single transparency in a single line (see example). Try to hold your group to five goals only.

goal	
goal	leave
goal	blank
goal	
goal	

Sample Transparency

2. A set of objectives under one or two of those goals. (hopefully one of these will deal with maintenance.)
3. An analysis of the tasks involved in the objectives specified in step two in which special requirements are noted.
4. Suggested teaching media for the objectives identified.

goal		
obj.	requir.	medium
obj.	requir.	medium

Sample Transparency

5. If time permits, identify hierarchy and modular structure.

Give out the predeveloped worksheets as needed a third to two third of the way through the session depending on how well your group is doing.

Worksheet #1	Identify Goals and Objectives
Worksheet #2	Task Analysis and Media Suggestions

other handouts

Hierarchical Structure
Modular Structure

In the second small session your group should develop a specified module. (See Objective 3.3 of Goal 3) At the end of the session you should have:

1. A description of the kind of responses the module requires from the student.
2. Selection of the type of program to be developed, e.g. drill, practice, simulation,etc.
3. A flowchart of the program on transparency.
4. A sample interaction on transparency. This should be very brief.

In this second session you should be very non-directive in terms of the type of program to be developed unless your group is very inexperienced. A variety of types of programs will allow us to discuss their comparative advantages during the following general discussion.

WORKSHEET #1

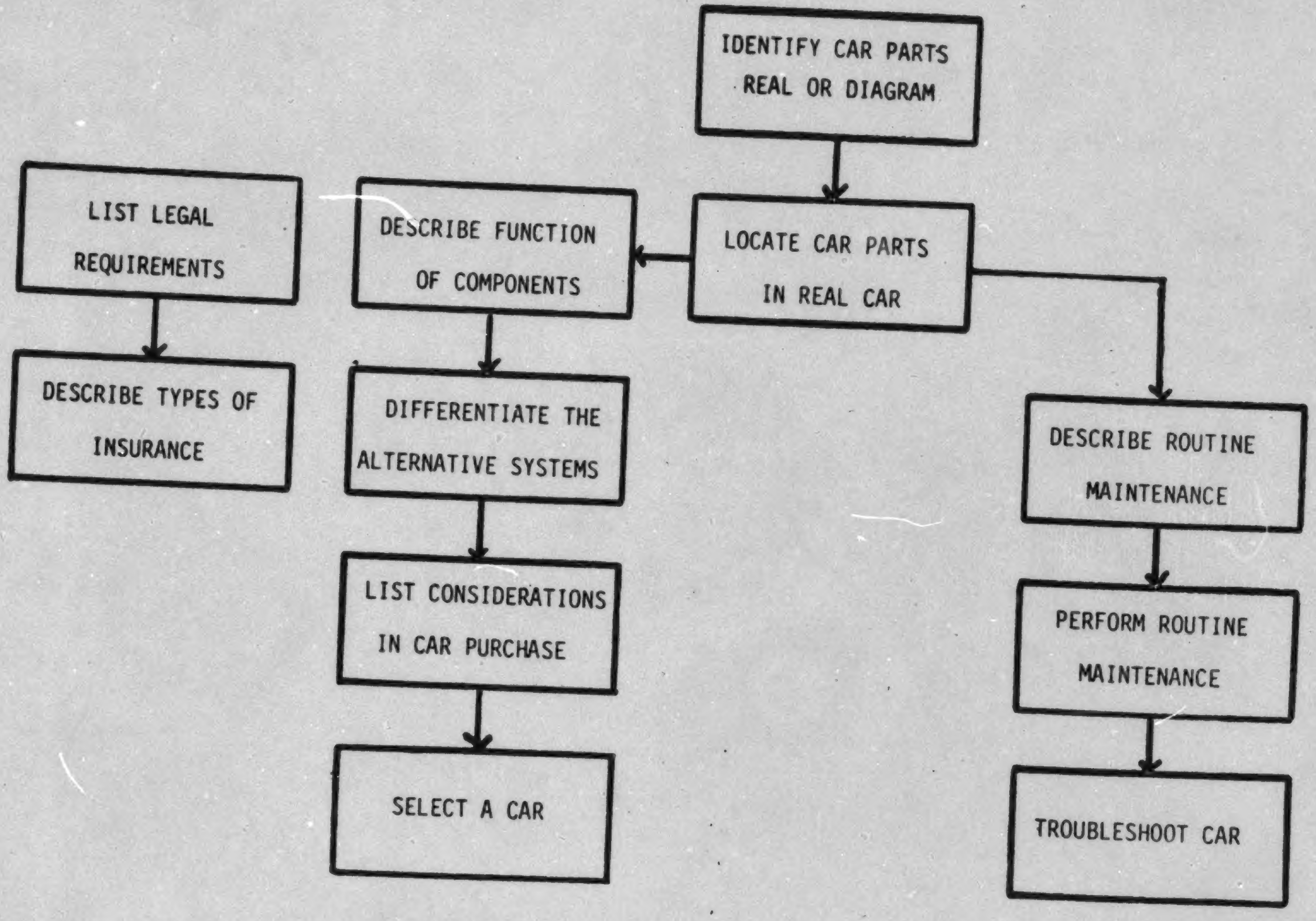
IDENTIFY GOALS AND OBJECTIVES

GOAL	OBJECTIVE
1. The student will know the parts of the car and its subsystems.	1.1 The student will be able to identify in a diagram or real life the major parts of the automobile and major subcomponents of the system such as air filters, spark plugs, etc. 1.2 The student will be able to locate the major components of a car when given a real car.
2. The student will understand the function of the major car systems and their components.	2.1 The student will be able to describe the function of each of the car systems and what part each of the components play. 2.2 The students will describe the difference between standard and automatic transmission, air and water cooled engines, disc and drum brakes, piston and rotary engines, diesel and gasoline fuel, power and manual brakes and steering, fuel injection versus carburetion.
3. The student will be aware of what is necessary to maintain the car in good running condition and be able to do so.	3.1 The students will be able to describe the major types and timing of routine maintenance such as oil change, lubrication, tire rotation, plugs and points change, etc. 3.2 The student will be able to perform routine maintenance work on their personal cars or selected other cars if they don't own a car. 3.3 Given a problem situation, the student will be able to diagnose the possible cause and recommend a solution.
4. The student will be aware of the primary desirable characteristics in a car given a variety of conditions.	4.1 The student will be able to list the major features and considerations in buying a car. 4.2 Given a theoretical limited amount of money and a simulated need situation the students will be able to select an appropriate car from local available resources.
5. The students will understand the legal aspects of car ownership.	5.1 The students will be able to list the legal requirements for owning a car and will describe their own eligibility. 5.2 The student will be able to describe the primary varieties of insurance required and optional to car owners.

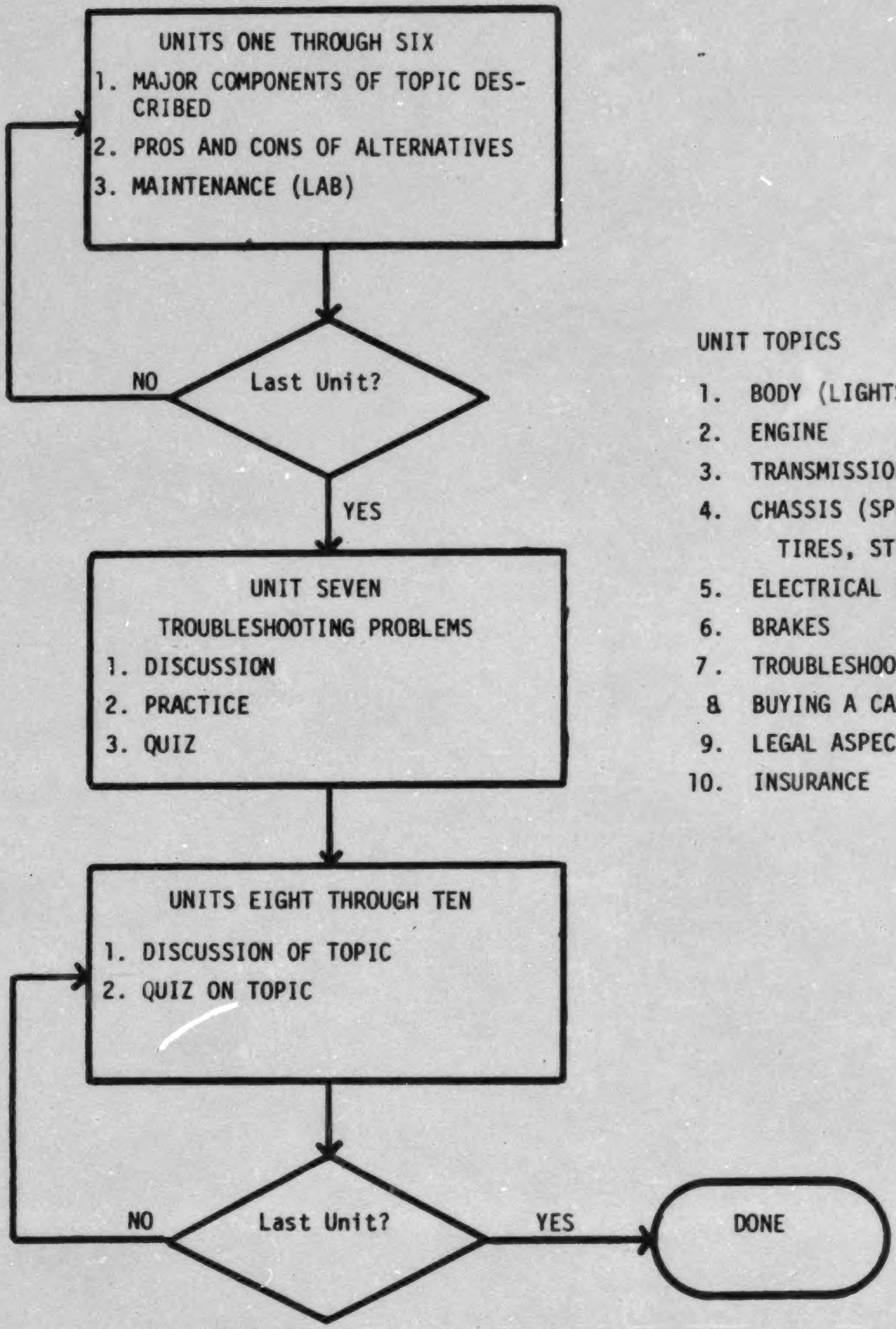
WORKSHEET #2

	TASK ANALYSIS PREREQUISITE SKILLS AND FACILITIES	MEDIA
1.1	NO SPECIAL REQUIREMENT	TEXT OR DEMO COMPUTER DRILL
1.2	NO SPECIAL REQUIREMENT	LAB-GARAGE
2.1	NO SPECIAL REQUIREMENT	TEXT OR LECTURE
2.2	NO SPECIAL REQUIREMENT	TEXT OR LECTURE
3.1	NO SPECIAL REQUIREMENT	TEXT OR LECTURE
3.2	KNOWLEDGE OF TOOLS, ABLE TO WORK ON CAR	LAB-GARAGE
3.3	NO SPECIAL REQUIREMENT	COMPUTER SIMULATION
4.1	NO SPECIAL REQUIREMENT	TEXT OR DEMO
4.2	ACCESS TO LOCAL RESOURCES (CAR DEALERS)	FIELDWORK
5.1	NO SPECIAL REQUIREMENTS	TEXT OR LECTURE
5.2	NO SPECIAL REQUIREMENT	TEXT OR LECTURE

HIERARCHIAL STRUCTURE


IDENTIFY CAR PARTS REAL OR DIAGRAM
LOCATE CAR PARTS IN REAL CAR
LIST LEGAL REQUIREMENTS
DESCRIBE TYPES OF INSURANCE
DESCRIBE FUNCTION OF COMPONENTS
DIFFERENTIATE THE ALTERNATIVE SYSTEMS
LIST CONSIDERATIONS IN CAR PURCHASE
SELECT A CAR
DESCRIBE ROUTINE MAINTENANCE
PERFORM ROUTINE MAINTENANCE
TROUBLESHOOT CAR

MODULAR STRUCTURE



UNIT TOPICS

1. BODY (LIGHTS, WIPERS)
2. ENGINE
3. TRANSMISSION
4. CHASSIS (SPRINGS, SHOCKS, TIRES, STEERING SYSTEM)
5. ELECTRICAL SYSTEM
6. BRAKES
7. TROUBLESHOOTING
8. BUYING A CAR
9. LEGAL ASPECTS
10. INSURANCE

PACKET FOR PARTICIPANTS

PACKET FOR PARTICIPANTS

This packet contains:

1. PROJECT C-BE Workshop overview.
2. Premise for workshop.
3. A Brief Workbook On Computer Material Design.
4. Workshop Evaluation Questionnaire.

PROJECT C-BE Workshop Overview

Instead of having a formal lecture on the process of computer material design, we felt it would be more interesting if the entire group embarked on a simulated course design. Therefore, the workshop this afternoon will follow this outline:

I. A brief overview of "Implementing the Computer As An Instructional Resource", and introduction to the workshop proceedings.

II. The large group will divide into several small groups and do a course analysis using the fictitious course provided by the workshop leaders.

III. The large group will reconvene to compare the course structures which were developed in the previous section.

IV. Taking one module from the course, the small groups will meet again to design a computer program to fit the needs of the module.

V. The large group will meet to compare the programs they have developed and discuss in general the process of program design.

In this process of give and take, we hope that we will learn from each other and thus derive the most from the workshop.

PREMISE

You have been asked to develop a course for Daggett Community College. The title of the course is "You and Your Car", and the following description is provided in the course catalog:

> "This course is designed to teach you about your car, its functioning and its maintenance." (Twelve-week course, three meetings per week.)

Daggett Community College has primarily local residents as students. The class sizes are generally about twenty students per class. It has shop and garage facilities for work on cars. Its well-equipped media production center can provide a moderate amount of visual and audio material and equipment at no cost to the faculty. Its computer facilities consist of a medium scale computer system providing both time-share and batch processing. Computer languages available are APL, ALGOL, FORTRAN, COURSEWRITER, and BASIC. Interactive terminals of either the CRT or teletypewriter type are readily available for student use. The college has no funds to purchase additional equipment.

Workshop Evaluation Questionnaire

Please answer the following points by circling the appropriate number.

1. The overview on "Implementing the Computer as an Instructional Resource" was:

clear	1	2	3	4	5	unclear
informative	1	2	3	4	5	uninformative
useful	1	2	3	4	5	not useful

Comments:

2. The first group session defining goals and objectives was:

informative	1	2	3	4	5	uninformative
useful	1	2	3	4	5	not useful

Comments:

3. The second small group session on "designing a module" was:

informative	1	2	3	4	5	uninformative
useful	1	2	3	4	5	not useful

Comments:

4. The comparison of group results was:

informative	1	2	3	4	5	uninformative
useful	1	2	3	4	5	not useful

Comments:

5. The opportunity for workshop participants to try out the sample module was:

interesting	1	2	3	4	5	uninteresting
informative	1	2	3	4	5	uninformative

Comments:

6. Rate the overall workshop in terms of the following scales:

	high				low
interest level	1	2	3	4	5
clarity	1	2	3	4	5
organization	1	2	3	4	5

Comments:

7. How could we improve the workshop to increase its value to you?

8. Before attending the workshop, I:

   a. Wanted to use computer-based modules in my own course.

   b. Was undecided whether to use computer-based modules in my course.

   c. Had decided using such modules would not be feasible in my situation.

9. After attending this workshop, I:

   a. Want to use computer-based modules in my own course.

   b. Am undecided whether to use computer-based modules in my own course.

   c. Have decided using such modules would not be feasible in my situation.

If you selected "c" above, what led you to this decision?

Name:____

Department:___________________________________

School:______________________________________

To assist us in evaluating our workshop and your reactions to the materials presented, please fill out the following questionnaire and return it to your group leader.

A BRIEF WORKBOOK
ON
COMPUTER MATERIAL DESIGN

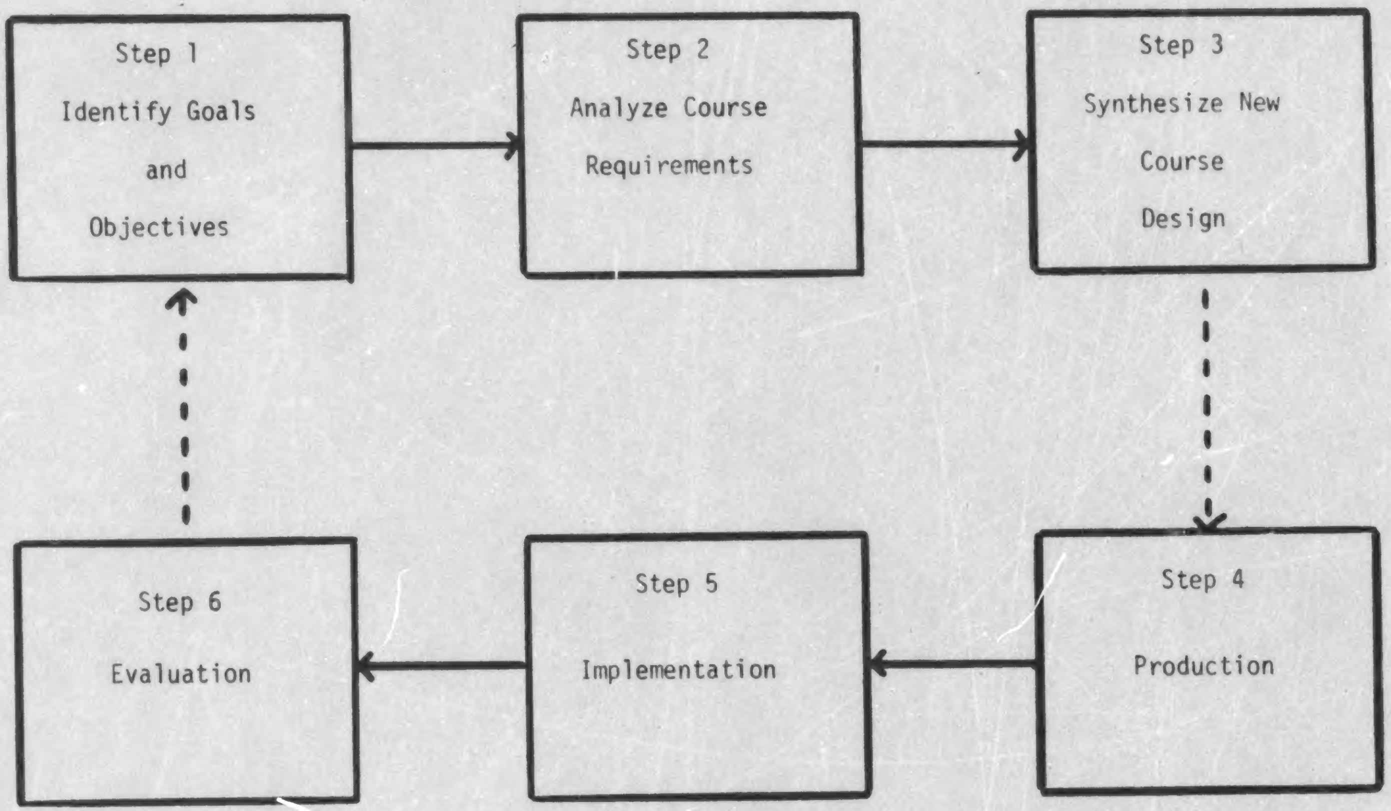
Marilla Svinicki

*The materials contained herein were supported by PROJECT C-BE under Grant HES 71-04422, "The Use of Computer-Based Teaching Techniques in Undergraduate Science and Engineering Education", from the National Science Foundation to the University of Texas at Austin, Drs. John J. Allan and J.J. Lagowski, Co-Directors.

A Brief Workbook
on
Computer Material Design

Anyone embarking on an attempt to improve their teaching through the use of computers must exercise a great deal of caution and restraint. In the past, too many have begun using the computer for its own sake rather than its educational value. In these times of shrinking resources for education no institution can afford such expenses without a good justification. Therefore, a systematic approach to curriculum revision is presented in this pamphlet to help a developer avoid costly errors in program production.

Steps in the Design Process



Only the first three steps will be included in the workshop.

STEP 1:

IDENTIFY GOALS AND OBJECTIVES

The first and most important step in the process is the identification of the goals and objectives of the course under revision.

A GOAL--A general statement identifying the limits of the material or skills to be mastered.

EXAMPLES: The students will examine the history of the United States from 1776 to 1860 with specific attention to the institutions of government.

The students will be able to critically analyze research data.

The students will learn the techniques of qualitative analysis.

AN OBJECTIVE--A specific behavioral description of the intended outcome of instruction.

EXAMPLES: The student will write an essay in class describing the major decisions of the Supreme Court concerning slavery in the period from 1880 to 1860 and their effort on the industry of the South.

Given a published article on a research study, the student will discuss in a group the type of assumptions, analysis and conclusions made in the study.

Given a test sample, the student will be able to identify the substance through the use of the appropriate procedures.

Sources for goals and objectives can be identified by asking the following questions:

1. What is the recommended curriculum established by a recognized discipline committee?
2. Is this a required course and why?
3. What are the course prerequisites?
4. What courses normally precede the course?
5. What courses typically follow the course?
6. What are the student expectations for the course?
7. What are the instructor's expectations for the course?
8. If the course is designed to train specialists, what are the task requirements?

The developer should identify first his course goals and then the specific objectives related to those goals as shown in the sample worksheet "Identify Goals and Objectives", which follows.

Once the objectives have been delineated, the instructor should evaluate the present method of teaching the course, if it is an existing course, to determine if those objectives are being achieved. It may be that some are and some are not. By making such an analysis, the instructor may find it possible to retain some aspects of the existing course or may find the entire structure must be redone.

STEP 2:

ANALYZE COURSE REQUIREMENTS

The next step in the procedure is to analyze the tasks set out in the objectives and the type of course structure needed to meet the objectives. The instructor should break each task down into its component parts to find commonalities or hierarchial relationships among the tasks. This breakdown can then be used to divide the material into conceptual units. This modularization facilitates both the construction of material, and their assimilation by students. (See "Sample Task Analysis" Worksheet.)

The instructor must look for special skills that the students may need and for special requirements of tasks which would point toward a particular instructional mode or medium. For example, drill in a foreign language or noun gender can easily be handled by a computer, but drill in pronunciation requires audio-capabilities which may be handled more easily by a tape recorder.

Sample Worksheet
Identify Goals and Objectives

Goals:

1. The students will have a knowledge of the general features of U.S. geography.
2. The students will develop map reading skills for the major map types.

Objectives:

1. The student will be able to name a state capital when given the state name and vice versa.
2. The student will be able to list the fifty states, the major mountain ranges, major inland lakes major rivers of the continental U.S.
3. Given a map of the U.S., the student will be able to locate the major features of U.S. geography named in the previous objective.

1. For any one of the three major types of maps, the student will be able to locate and interpret the data by answering short answer questions on the major features of the map.

   Ex. On a topographical map, locate the lowest points in terms of altitude by plotting their latitude and longitude.

Sample Task Analysis
Zoology Laboratory (Partial)

1. The student will prepare slides of cells in all stages of mitosis.	2. The student will identify previously prepared slides of different cell types.
1. Must prepare specimen to promote mitosis 2. Must fix specimen in parafin 3. Must operate microtome 4. Must fix and stain slides 5. Must operate microscope 6. Must identify mitosis stages on prepared slides 7. Must prepare description of slides	1. Must operate microscope 2. Must be familiar with cell types 3. Must prepare description of slides

COMMONALITIES

Operation of microscope
Preparing slide description

HIERARCHIAL STRUCTURE

I. a. Operation of microscope basic to all skills.
   b. Understanding of what is seen through microscope.
   c. Preparing stained slides from professionally fixed specimen.
   d. Preparing specimen for slides.

II. Identify Cell Types and Mitosis Stages (not related to hierarchy)

SUGGESTED MODULARIZATION

UNIT 1	OPERATION OF MICROSCOPE
UNIT 2	IDENTIFY AND DESCRIBE PREPARED SLIDES (Objective 2)
UNIT 3	USE FIXED SPECIMEN TO PREPARE AND STAIN SLIDES
UNIT 4	PREPARE, FIX SPECIMEN, PREPARE, FIX, STAIN SLIDES
UNIT 5	PREPARE MITOSIS SLIDES AND DESCRIPTION (Objective 1)

Taking all these factors into account, the instructor should select what appears to be the appropriate medium to present each of the objectives or goals (See "Sample Media Selection" Worksheet) as well as the approximate order of presentation. Once a medium is selected, the instructor should review the literature to determine if a system which fits his needs already exists elsewhere. If so, much time can be saved.

STEP 3:

SYNTHESIZE NEW COURSE DESIGN

The instructor now designs the materials according to the analysis made in the previous step. If one or more modules of the course have been designated for computer use, the instructor makes the decision as to the type of program which would best help the students achieve the instructional objectives for the module. Three major uses of the computer might be involved:

1. Tutorial aid--used to present new material and drill the students on its concepts.
2. Computational aid, simulation aid, laboratory aid--used to assist the student in the application of material learned elsewhere to practical situations.
3. Managerial aid--used by the instructor to monitor student progress, generate examinations, etc.

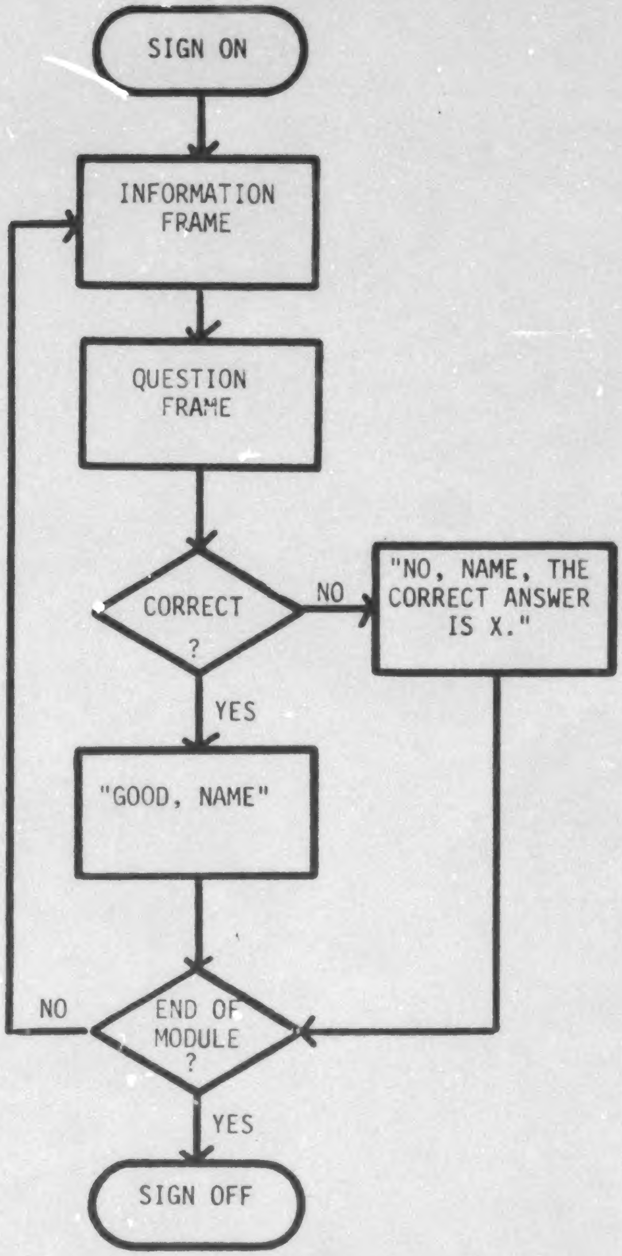
Factors to consider in selecting the type of program are:

1. Hardware and software capabilities (terminal facilities, storage, etc.)
2. Type of response required (multiple choice, free response, etc.)
3. Special requirements for material presentation (e.g., slide display)
4. Basic objective of module (drill, problem solving, etc.)
5. Probable complexity of program for both programmer and user

After deciding on the type of presentation mode for a module, the instructor should produce a flowchart and author's draft showing how a student would progress through the material (see "English Tutorial" example). These are used in consultation with the programmer to produce the initial draft of the program.

Sample Media Selection
Art History

Goal or Objective		
1. The student will prepare a chronology of artists (given) and their respective styles.	2. The student will identify the style associated with a given painting.	3. The student will be able to produce a reasonable approximation of a drawing or painting in a major style.
TEXT	Computer-controlled random access projector for drill and practice. TEXT for original description of styles.	Studio work with teaching assistant, self-paced



ENGLISH TUTORIAL MODULE

English Tutorial
Module 1 - Section 1
(S. Student input; C. Computer output)

C. The English sentence has two basic components, the subject and the verb. The subject of an active sentence base describes the person or thing that performs an action; the verb describes the action he performs. For example, in this very simple sentence,

The horse ran.

the word "horse" (the subject) describes the actor that performs an action; the word "ran" (the verb) describes the action performed by the subject.

C. What's the subject of this sentence?

The dog bites.

S.	dog	C.	Good, name
S.	other	C.	No, name, the correct answer is "dog"

C. What's the verb?

S.	bites	C.	Right, name.
S.	other	C.	No, name, the correct answer is "bites"

C. The sentence base we have just looked at is called the subject-verb base (S-V). It is the simplest sentence base in English. Usually, however, the base includes other words which add useful information to the base:

1. Determiners (a, an, the, this, my, some, etc.) specify the noun by identifying it.

2. Adjectives specify the noun by describing it.

3. Adverbs specify the verb by describing it.

C. For example,

Sue arrived early.

What kind of sentence base is this?

S. S-V C. Right, name

S. other C. No, name the correct answer is S-V

The verb arrived is specified by the adverb early, which describes the verb and adds information to the base.

Sometimes in an S-V base, the adverb comes first:

Anxiously, he waited at the door.

Don't let this inversion confuse you--the basic sentence pattern is still S-V.

Identify the subject in this base:

S. he C. Very good, name

S. other C. No, name, the subject is "he".

(Randomly select five test sentences from the included list and keep record of student error rate.)

(If error rate is less than 2, do the following:)

C. Very good, name.

You should sign off for now until you want to do the next unit.

(If error rate is greater than 2 or equal to 2, do the following:)

C. Well, name, you seem to need some work on this unit.
Would you like to try some additional sentences?

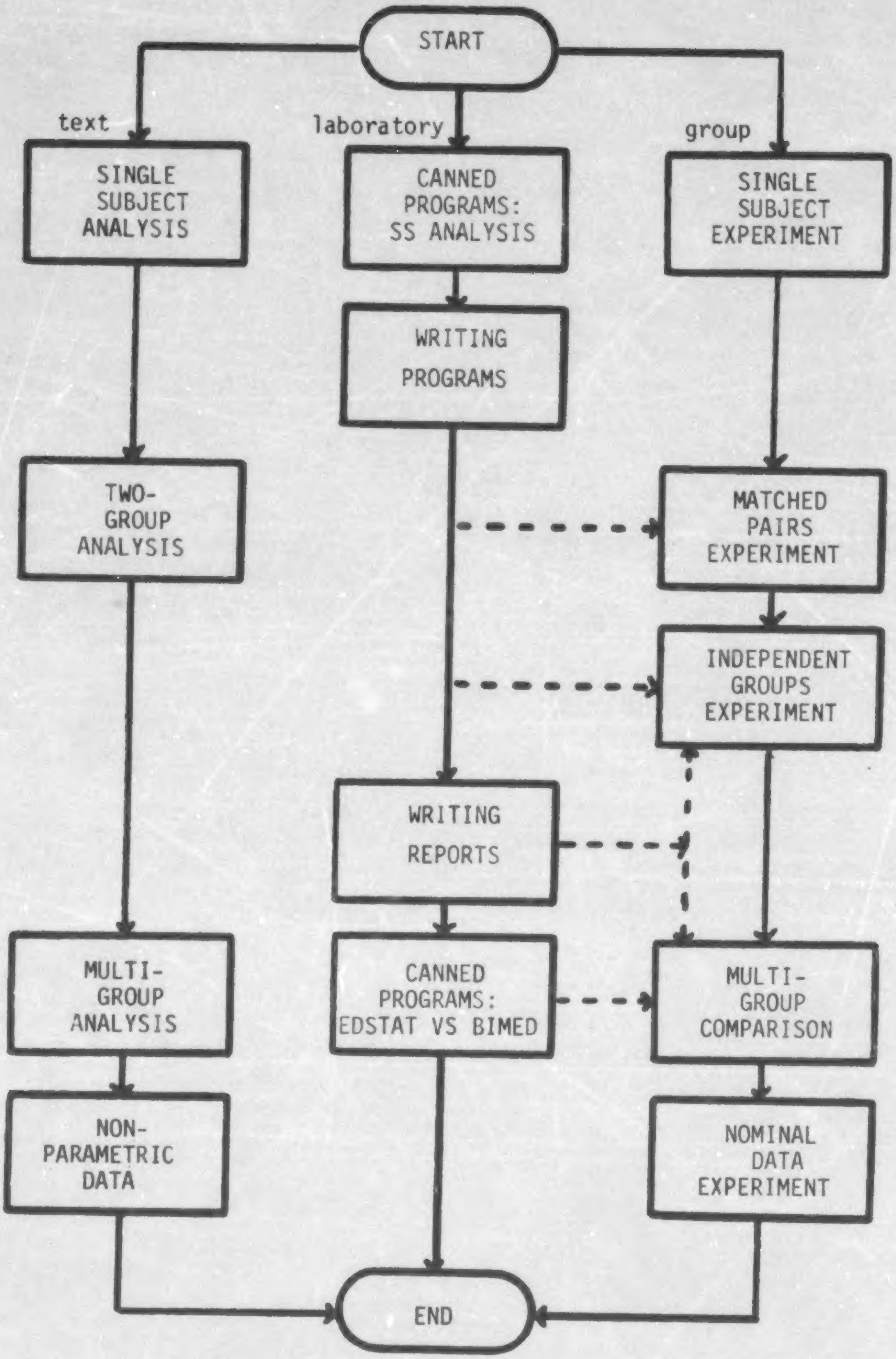
Type "yes" if you would and "no" if you are finished for today.

S. Yes (continue on to next unit)

S. No C. Very well. Sign off and I'll see you soon.

In addition to the individual modules, a master flowchart showing a student's progress through all the modules should be drawn (see "Statistics" example) to insure coordination among the parts.

One phase of planning which most instructors neglect is planning for evaluation and transfer. The former is needed to be sure that the course changes which are being instituted are actually an improvement both educationally and fiscally or at least the most efficient system under the circumstances. It is additionally important to set these plans before beginning production to be sure the data required are collected from the outset. The planning for transfer must be done early in the development process because it will affect things such as language and equipment selection. Transfer should be considered not just so that instructors at other universities can use the program but also because the developer may have occasion to move it to a new system. Planning for transfer before the fact can save later modification effort.



MASTER FLOWCHART FOR STATISTICS

PRODUCTION, IMPLEMENTATION, EVALUATION

The production, implementation and evaluation of the new materials follow on the heels of this design phase but will not be considered in this workshop. They are discussed in detail in the larger version of this workbook, Designing Computer-Based Education, available through PROJECT C-BE at the University of Texas at Austin. We feel that the design phases covered in this workshop are the most important in the production of computer programs for education, particularly when they result in the decision not to use the computer. Many programs currently computerized could have as easily been done by other means. Thoughtful planning prior to programming might have avoided such unnecessary waste.

Worksheet #1

Identify goals and objectives

	Goals		
Objectives			

Worksheet #2

Task Analysis

Objectives			
Task Components			

Worksheet #3
Media Selection

Goal or Objectives			
Method of Presentation			

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MODULE DOCUMENTATION

TROUBLESHOOTING MODULE

Author's Draft.

PROBLEM SITUATION

It's a rainy summer day. You have been driving your car for an hour. You stopped briefly at a store and now your car won't start. Your car is three years old, has a water-cooled, spark ignition type engine, an automatic transmission and air conditioning.

The following is a list of actions you might want to take. Type the letter of the action you want to take first and enter.

(Acceptable Input A, B, C, D, E, F, G, H, I, J, K, L, M, N)

ACTION LIST:

A Check fuel gauge
B Check temperature gauge
C Check gear selector
D Turn off radio and lights, etc.
F Wait ten or more minutes
G Turn starter key
H Depress accelerator halfway and turn starter key
I Press accelerator all the way to the floor, hold it and turn starter key
J Pump accelerator and turn starter key
K Ask car behind you to give you a push
L Look under the hood
M Jump battery with cables
N Tow car into garage

ACTION LIST FOR L
CHECKING UNDER THE HOOD

L-0 I finished looking under the hood

L-1 I want to check the battery

L-2 I want to check the spark plugs

L-3 I want to check the fan belt

L-4 I want to remove air filter, cover carburetor with my palm and have someone operate the starter

L-5 I want to check the oil

L-6 I want to check the fuses and circuit breakers

L-7 I want to check the radiator

ACTION RESPONSES:

A 1. Your fuel tank is half full. Which action do you want to take next?

2. Your fuel tank is empty. No wonder your car did not start. Don't attempt to restart engine before you refueled the tank. You have completed this problem situation.

B 1. Your temperature gauge is in mid-position. Which action do you want to take next?

C 1. Your gear selector is in "N" (neutral). Which action do you want to take next?

D 1. Okay, this relieves the battery of excessive load. Which action do you want to take next?

E 1. Okay, this is a good idea. Your engine may be flooded, this will also rest your battery. Which is going to be your next action?

F 1. Are you sure waiting that long will solve your problem? Which action do you want to take next?

2. You might have a vapor lock and waiting is the only correct action. To speed things up, raise your hood and put a wet rag on the fuel pump and the fuel line to the carburetor to cool the vaporized gasoline inside. What will be your next action?

3. Okay, what will be your next action?

G 1. You are cranking the engine. It does not start. Which action do you want to take next?

2. Everything is dead. Which action do you want to take next?

3. Hurrah, your car is starting. You have completed this problem situation.

H (Same as G)

I 1. You are cranking the engine. It does not start. Which action do you want to take next?

2. Everything is dead. Which action do you want to take next?

3. Hurrah, your car is starting. You have completed this problem situation.

4. Your engine is starting--keep your foot steadily on the gas pedal until the engine smooths out. This will keep the engine from flooding. Then let your car idle at least 30 seconds before shifting into gear and starting off. You have completed this problem situation.

J 1. (Same as I1.)

2. Your engine starts briefly and stops again.

3. (Same as I2.)

K 1. You are unsuccessful to start the car this way. What is your next action?

L 1. The following is a list of actions you might want to take. Type the number of the action you want to take.
(Possible Actions 0, 1, 2, 3, 4, 5, 6, 7)

2. Everything looks okay. Your motor is still warm. The following is a list of actions you might want to take. Type the number of the action you want to take first.

3. Everything looks okay. Your motor is still warm. There is an odor of gasoline. The following ....

L-0 1. You finished checking under the hood. Which action do you want to take next?

L-1 1. The battery water level is okay. Battery cables are tight and not corroded.

2. Your cables are badly corroded. Remove cables, clean battery terminals, and check tightness of cable connections to engine. Your car will start now and you have completed this problem situation.

L-2 1. Your spark plugs are okay. You just changed them three weeks ago. The connector cables are tight. Which action do you want to take next?

2. Your spark plugs and cables are wet. Dry off top of ignition coil, all cables and spark plug porcelain with a rag. Your car will start now. You have completed this problem situation.

L-3 1. Your fan belt is okay. Which action do you want to take next?

L-4 1. Okay, your car still doesn't start. What's your next action?

2. Your car is starting. The suction removed the dirt blocking your fuel line. Replace your air filter. You have solved this problem situation.

L-5 1. Your oil is okay. What's your next action?

L-6 1. Your fuses and circuit breakers are okay. Which action do you want to take next?

POSSIBLE CAUSES

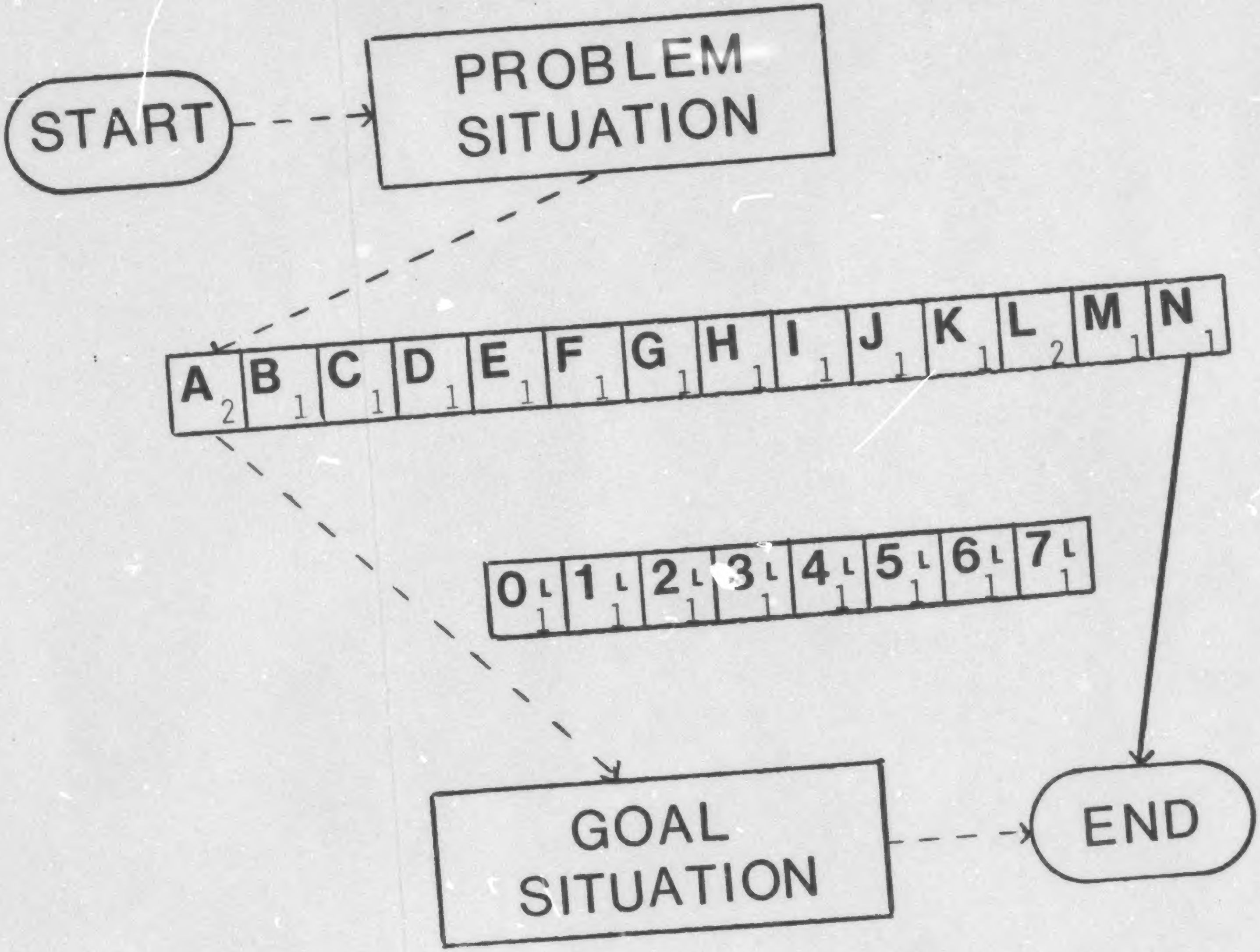
1. Empty fuel tank
2. Flooded carburetor
3. Dirt in fuel system
4. Corroded battery cables
5. Vapor lock
6. Blown fuse
7. Wet Ignition

This list could easily be extended. Modules could also be designed for various types of cars in a similar way, e.g., standard transmission vs. automatic, air cooled engine vs. water cooled one, etc.

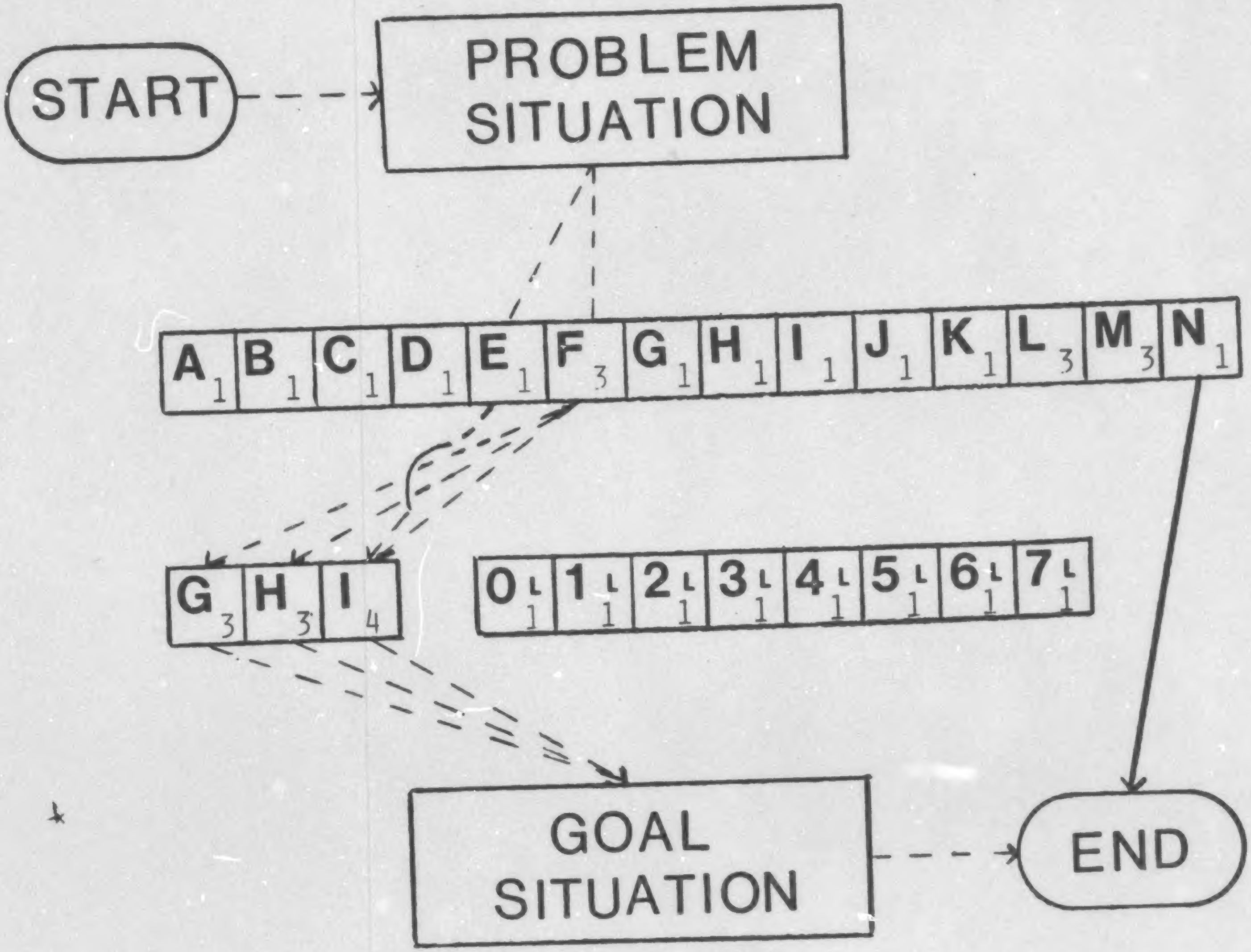
The following charts show the solution paths for the various causes of that problem situation. The blocks represent the possible actions the number in the bottom righthand corner of each block gives the answer key. For example:

CAUSE: Empty fuel tank
STUDENT ACTION: D - Turn off radio and lights, etc.
COMPUTER RESPONSE: D-1 - Okay, this relieves the battery of excessive load.

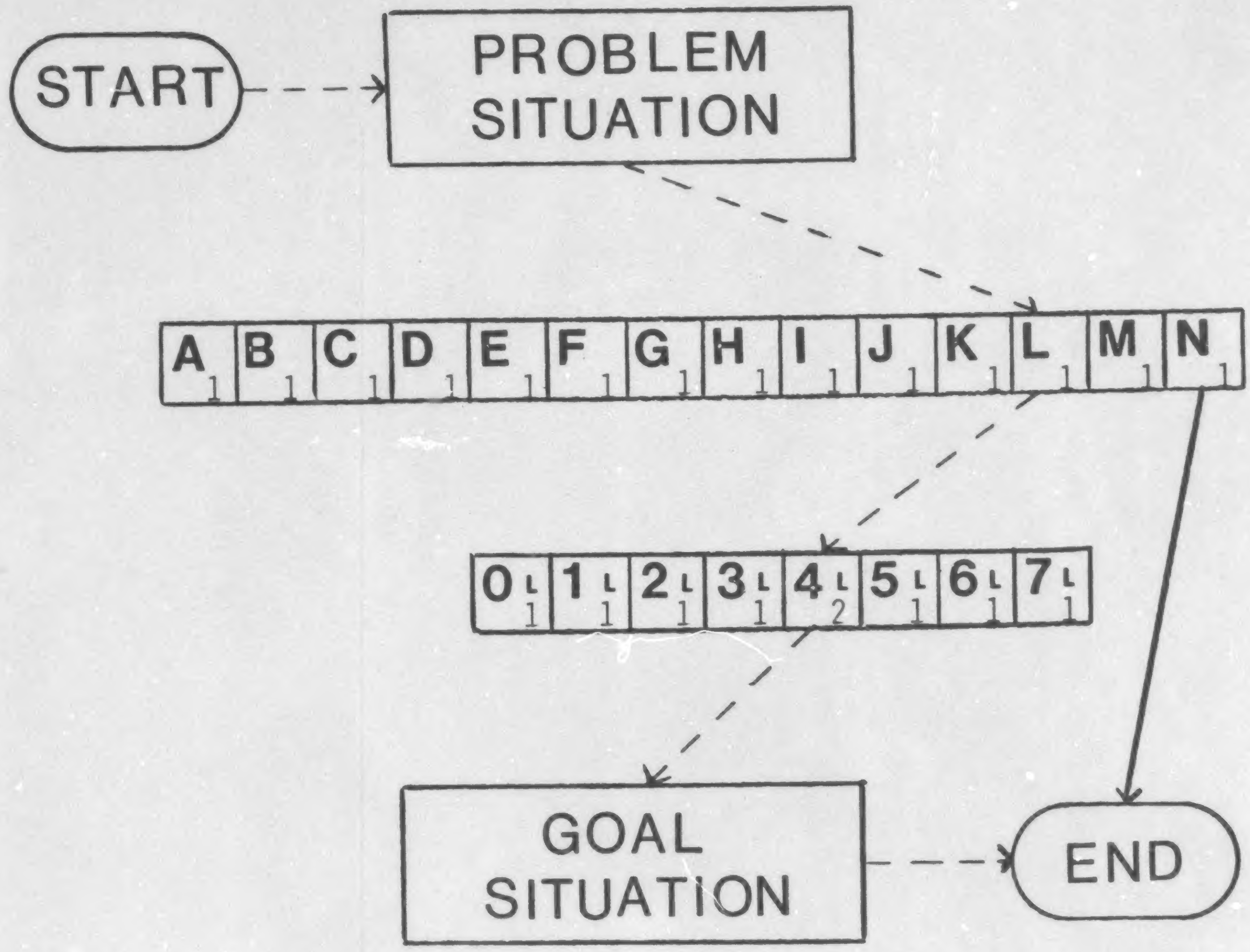
STUDENT ACTION: G - Turn starter key.
COMPUTER RESPONSE: G-1 - You are cranking the engine. It does not start.


START
PROBLEM SITUATION
A_2 B_1 C_1 D_1 E_1 F_1 G_1 H_1 I_1 J_1 K_1 L_2 M_1 N_1
$0L_1$ $1L_1$ $2L_1$ $3L_1$ $4L_1$ $5L_1$ $6L_1$ $7L_1$
GOAL SITUATION
END

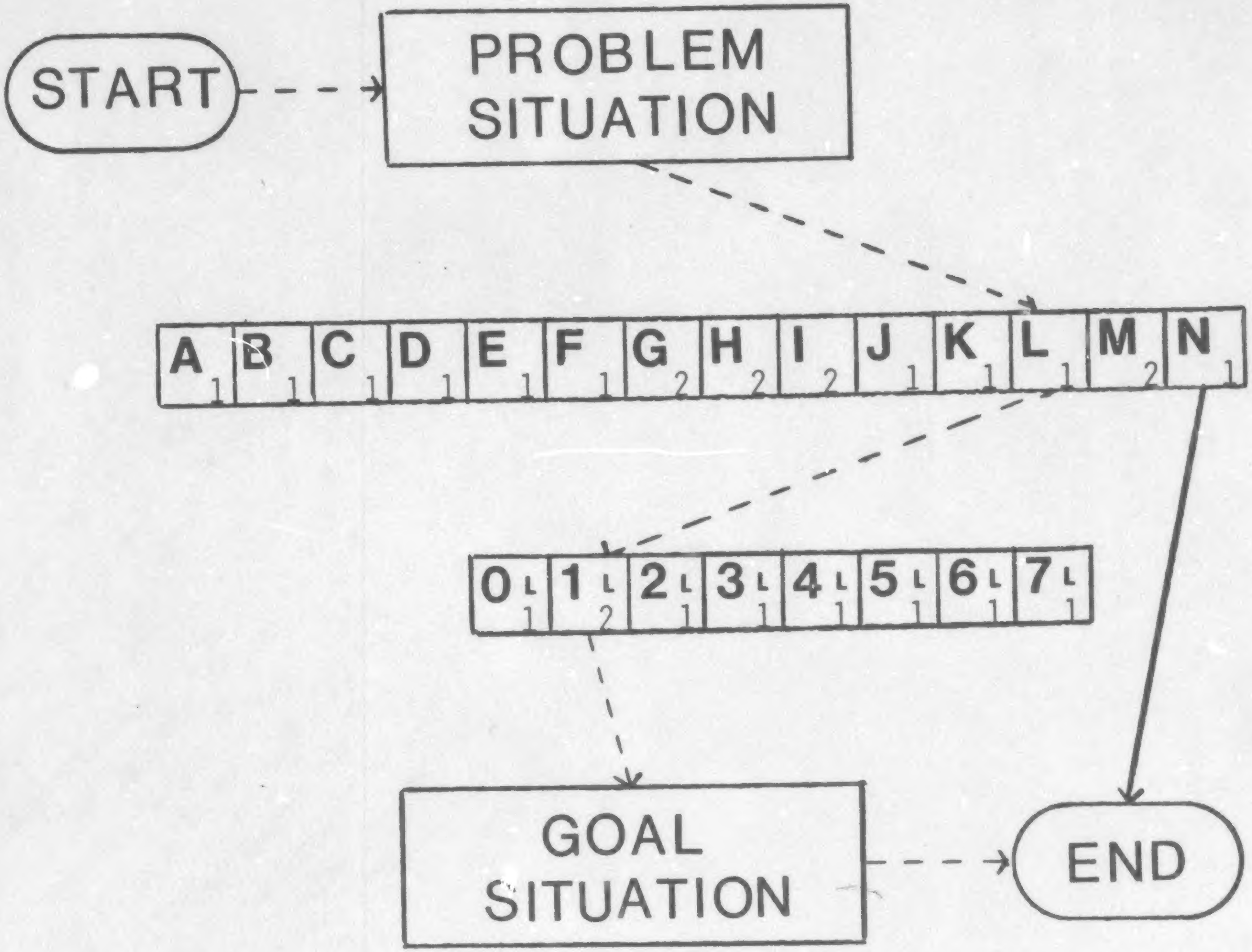
CAUSE: EMPTY FUEL TANK



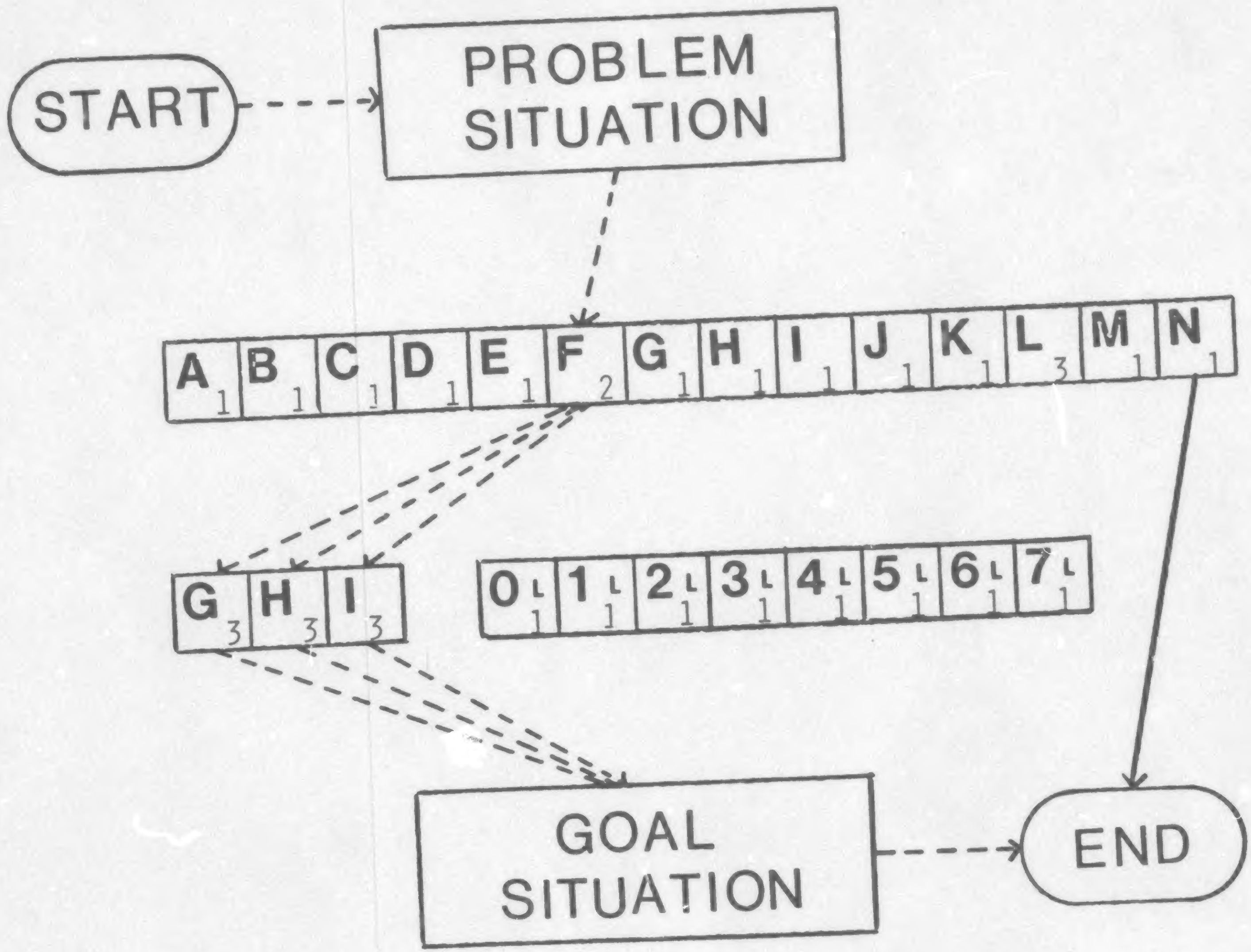
CAUSE: FLOODED CARBURETOR


START
PROBLEM SITUATION
A₁ B₁ C₁ D₁ E₁ F₁ G₁ H₁ I₁ J₁ K₁ L₁ M₁ N₁
0L1 1L1 2L1 3L1 4L2 5L1 6L1 7L1
GOAL SITUATION
END

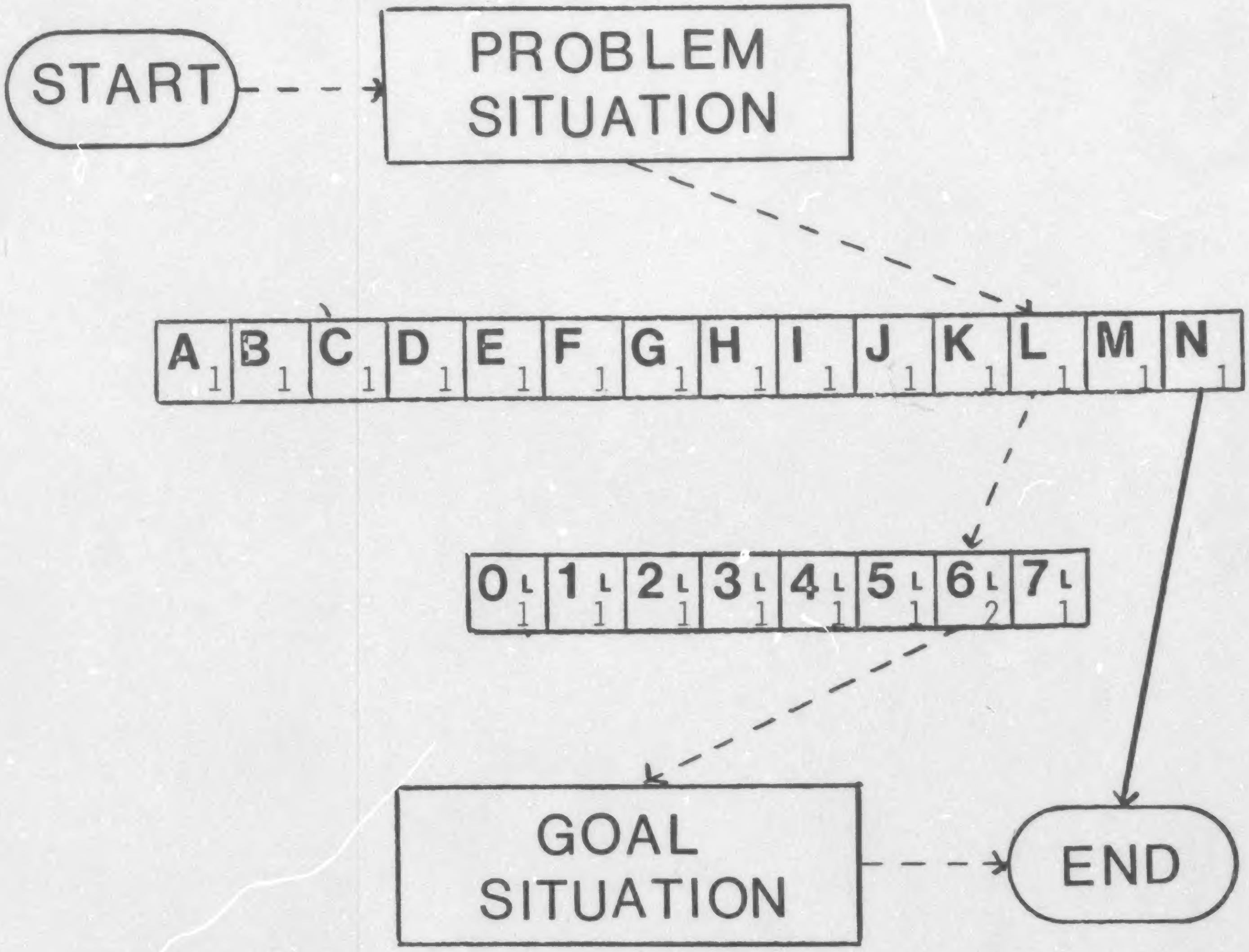
CAUSE: DIRT IN FUEL SYSTEM



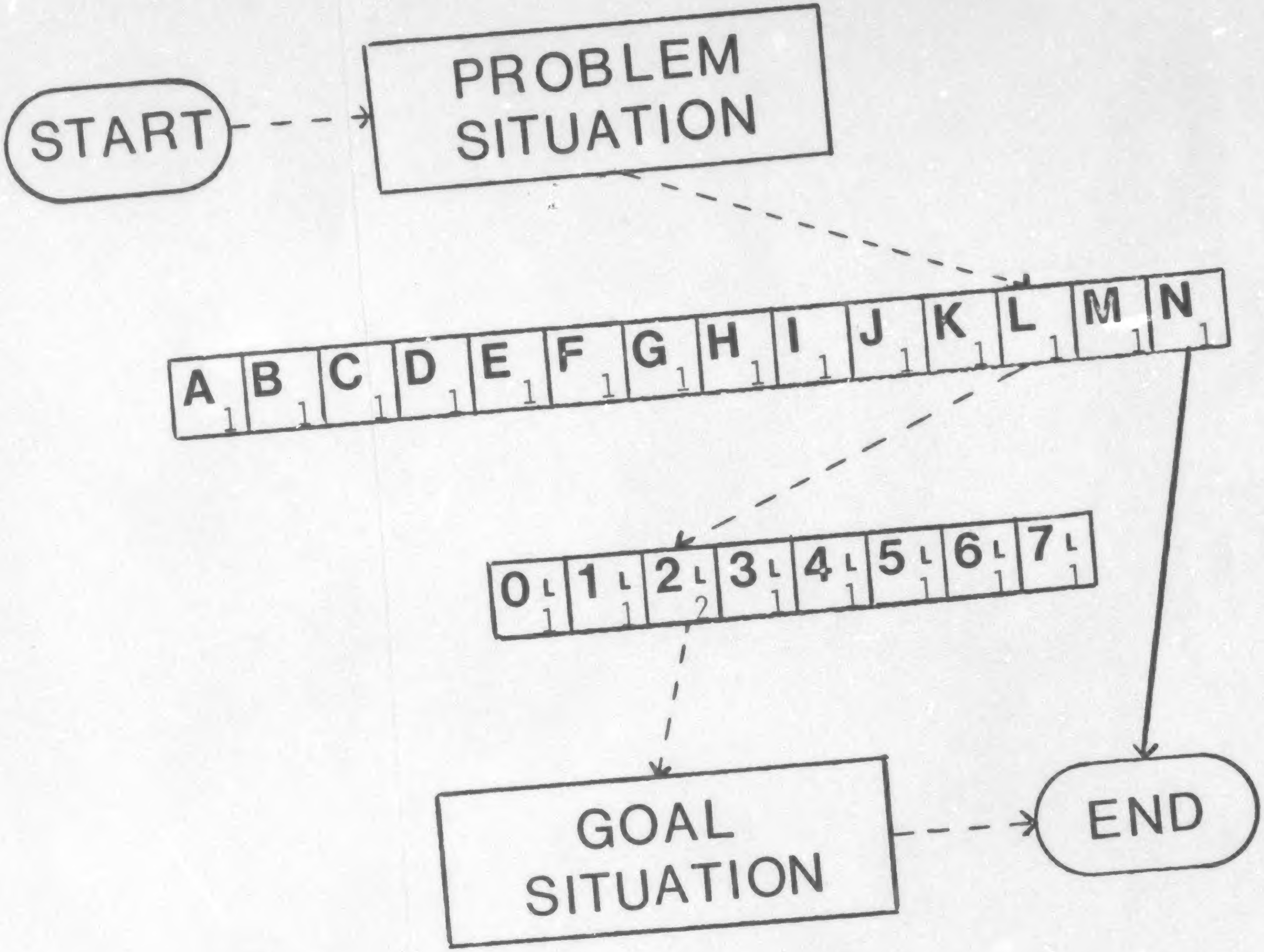
CAUSE: CORRODED BATTERY CONNECTORS



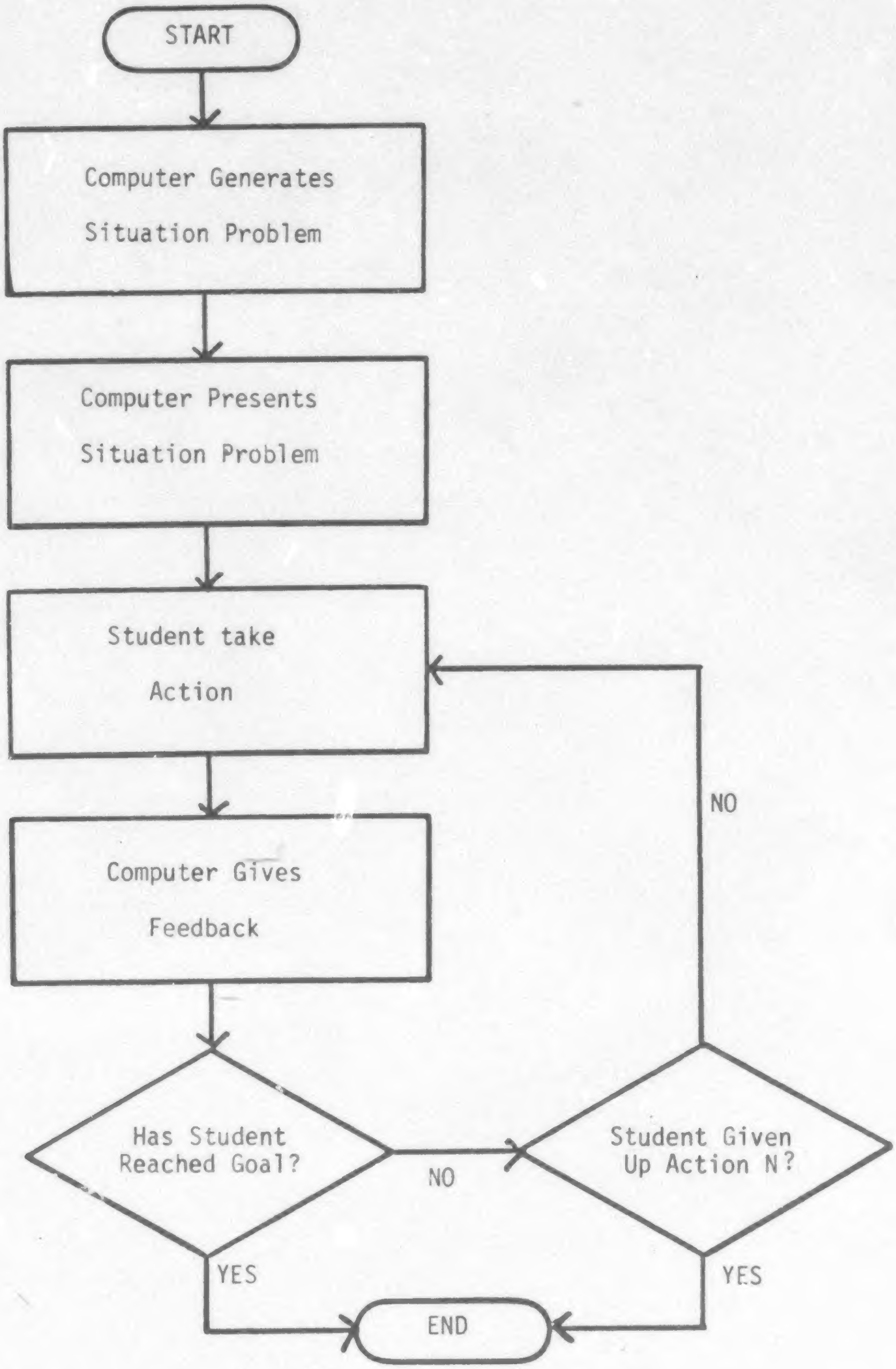
CAUSE: VAPOR LOCK



CAUSE: BLOWN FUSE OR OPEN CIRCUIT BREAKER



CAUSE: WET IGNITION



MODULE FLOW CHART

```
* LIST
0010 DIM L$[1],M$[1],N$[1],H[7],K[14],U[7]
0020 GOTO 2510
0030 PRINT
0040 PRINT "0 --- I FINISHED LOOKING UNDER THE HOOD"
0050 PRINT "1 --- I WANT TO CHECK THE BATTERY"
0060 PRINT "2 --- I WANT TO CHECK THE SPARK PLUGS"
0070 PRINT "3 --- I WANT TO CHECK THE FAN BELT"
0080 PRINT "4 --- I WANT TO REMOVE AIR FILTER, COVER CARBURETOR "
0090 PRINT "       WITH MY PALM AND HAVE SOMEONE OPERATE THE STARTER"
0100 PRINT "5 --- I WANT TO CHECK THE OIL"
0110 PRINT "6 --- I WANT TO CHECK THE FUSES AND CIRCUIT BREAKERS"
0120 PRINT "7 --- I WANT TO CHECK THE RADIATOR"
0130 PRINT
0140 RETURN
0150 REM
0160 PRINT "TYPE THE NUMBER OF THE ACTION WHICH YOU WISH TO TAKE."
0170 PRINT "TYPE 'P' FOR A LIST OF POSSIBLE ACTIONS UNDER THE HOOD."
0180 INPUT N$
0190 IF N$<>"P" THEN GOTO 0230
0200 GOSUB 0030
0210 PRINT "NOW TYPE THE NUMBER OF THE ACTION YOU WISH TO TAKE."
0220 INPUT N$
0230 IF N$="0" THEN GOTO 0330
0240 IF N$="1" THEN GOTO 0360
0250 IF N$="2" THEN GOTO 0480
0260 IF N$="3" THEN GOTO 0600
0270 IF N$="4" THEN GOTO 0620
0280 IF N$="5" THEN GOTO 0720
0290 IF N$="6" THEN GOTO 0740
0300 IF N$="7" THEN GOTO 0850
0310 PRINT "NOT A VALID ACTION NUMBER."
0320 GOTO 0150
0330 PRINT "YOU FINISHED LOOKING UNDER THE HOOD."
0340 LET F=0
0350 RETURN
0360 LET Y=H[1]
0370 IF Y=1 THEN GOTO 0400
0380 IF Y=2 THEN GOTO 0430
0390 STOP
0400 PRINT "THE BATTERY WATER LEVEL IS OKAY.  BATTERY CABLES ARE TIGHT"
0410 PRINT "AND NOT CORRODED."
0420 GOTO 0900
0430 PRINT "YOUR CABLES ARE BADLY CORRODED.  REMOVE CABLES, CLEAN"
0440 PRINT "BATTERY TERMINALS, AND CHECK TIGHTNESS OF CABLE"
0450 PRINT "CONNECTIONS TO ENGINE.  YOUR CAR WILL START NOW."
0460 LET F=1
0470 RETURN
0480 LET Y=H[2]
0490 IF Y=1 THEN GOTO 0520
0500 IF Y=2 THEN GOTO 0550
0510 STOP
0520 PRINT "YOUR SPARK PLUGS ARE OKAY.  YOU JUST CHANGED THEM THREE WEEK
S"
0530 PRINT "AGO.  THE CONNECTOR CABLES ARE TIGHT."
0540 GOTO 0900
0550 PRINT "YOUR SPARK PLUGS AND CABLE ARE WET.  DRY OFF TOP OF IGNITION
"
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0560 PRINT "COIL, ALL CABLES AND SPARK PLUG PORCELAIN WITH A RAG.  YOUR"
0570 PRINT "CAR WILL START NOW"
0580 LET F=1
0590 RETURN
0600 PRINT "YOUR FAN BELT IS OKAY."
0610 GOTO 0900
0620 LET Y=H[4]
0630 IF Y=1 THEN GOTO 0660
0640 IF Y=2 THEN GOTO 0680
0650 STOP
0660 PRINT "OKAY, YOUR CAR STILL DOESN'T START."
0670 GOTO 0900
0680 PRINT "YOUR CAR IS STARTING.  THE SUCTION REMOVED THE DIRT "
0690 PRINT "BLOCKING YOUR FUEL LINE.  REPLACE YOUR AIR FILTER."
0700 LET F=1
0710 RETURN
0720 PRINT "YOUR OIL IS OKAY."
0730 GOTO 0870
0740 LET Y=H[6]
0750 IF Y=1 THEN GOTO 0780
0760 IF Y=2 THEN GOTO 0800
0770 STOP
0780 PRINT "YOUR FUSES AND CIRCUIT BREAKERS ARE OKAY."
0790 GOTO 0900
0800 PRINT "ONE OF YOUR FUSES IS OUT.  REPLACE THE FUSE.  IF YOU DO"
0810 PRINT "NOT CARRY AN EXTRA FUSE START YOUR CAR BY JUMPING"
0820 PRINT "YOUR BATTERY AND GET A NEW FUSE."
0830 LET F=1
0840 RETURN
0850 PRINT "THE RADIATOR IF OKAY."
0860 GOTO 0870
0870 PRINT
0880 PRINT "WHAT'S YOUR NEXT ACTION?"
0890 GOTO 0170
0900 PRINT
0910 PRINT "WHICH ACTION DO YOU WISH TO TAKE NEXT?"
0920 GOTO 0170
0930 PRINT
0940 PRINT "A -- CHECK FUEL GAUGE"
0950 PRINT "B -- CHECK TEMPERATURE GAUGE"
0960 PRINT "C -- CHECK GEAR SELECTOR"
0970 PRINT "D -- TURN OFF RADIO AND LIGHTS, ETC. "
0980 PRINT "E -- WAIT A FEW MINUTES"
0990 PRINT "F -- WAIT 10 OR MORE MINUTES"
1000 PRINT "G -- TURN STARTER KEY"
1010 PRINT "H -- DEPRESS ACCELERATOR HALFWAY AND TURN STARTER KEY"
1020 PRINT "I -- DEPRESS ACCELERATOR ALL THE WAY TO THE FLOOR,"
1030 PRINT "      HOLD IT AND TURN STARTER KEY "
1040 PRINT "J -- PUMP ACCELERATOR AND TURN STARTER KEY"
1050 PRINT "K -- ASK CAR BEHIND YOUR TO GIVE YOU A PUSH"
1060 PRINT "L -- LOOK UNDER THE HOOD"
1070 PRINT "M -- JUMP BATTERY WITH CABLES"
1080 PRINT "N -- HAVE CAR TOWED TO GARAGE"
1090 PRINT
1100 RETURN
1110 PRINT
1120 PRINT "TYPE THE LETTER OF THE ACTION YOU WISH TO TAKE."
1130 PRINT "TYPE 'P' FOR A LIST OF POSSIBLE ACTIONS."
1140 INPUT L$
1150 IF L$<>"P" THEN GOTO 1190
1160 GOSUB 0930
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1170 PRINT "NOW TYPE THE LETTER OF THE ACTION YOU WISH TO TAKE."
1180 INPUT L$
1190 IF L$="A" THEN GOTO 1350
1200 IF L$="B" THEN GOTO 1450
1210 IF L$="C" THEN GOTO 1470
1220 IF L$="D" THEN GOTO 1490
1230 IF L$="E" THEN GOTO 1510
1240 IF L$="F" THEN GOTO 1540
1250 IF L$="G" THEN GOTO 1680
1260 IF L$="H" THEN GOTO 1680
1270 IF L$="I" THEN GOTO 1790
1280 IF L$="J" THEN GOTO 1900
1290 IF L$="K" THEN GOTO 1990
1300 IF L$="L" THEN GOTO 2010
1310 IF L$="M" THEN GOTO 2140
1320 IF L$="N" THEN GOTO 2300
1330 PRINT "NOT A VALID ACTION."
1340 GOTO 1120
1350 LET X=K[1]
1360 IF X=2 THEN GOTO 1410
1370 IF X=1 THEN GOTO 1390
1380 STOP
1390 PRINT "YOUR FUEL TANK IF HALF FULL."
1400 GOTO 2410
1410 PRINT "YOUR FUEL TANK IS EMPTY.  NO WONDER YOOR CAR DID NOT"
1420 PRINT "START.  DON'T ATTEMPT TO RESTART ENGINE BEFORE YOU"
1430 PRINT "REFILL THE TANK.  "
1440 GOTO 2340
1450 PRINT "YOUR TEMPERATURE GAUGE IS IN MID-POSITION."
1460 GOTO 2410
1470 PRINT "YOUR GEAR SELECTOR IS IN 'N' (NEUTRAL)."
1480 GOTO 2410
1490 PRINT "OKAY, THIS RELIEVES THE BATTERY OF EXCESS LOAD."
1500 GOTO 2410
1510 PRINT "OKAY, THIS IS A GOOD IDEA.  YOUR ENGINE MAY BE FLOODED,"
1520 PRINT "AND THIS WILL ALSO REST YOUR BATTERY."
1530 GOTO 2390
1540 LET X=K[6]
1550 IF X=1 THEN GOTO 1590
1560 IF X=2 THEN GOTO 1610
1570 IF X=3 THEN GOTO 1660
1580 STOP
1590 PRINT "ARE YOU SURE WAITING THAT LONG WILL SOLVE YOUR PROBLEM?"
1600 GOTO 2410
1610 PRINT "YOU MIGHT HAVE A VAPOR LOCK AND WAITING IS THE ONLY CORRECT"
1620 PRINT "ACTION.  TO SPEED THINGS UP RAISE YOUR HOOD AND PUT A WET RA
G"
1630 PRINT "ON THE FUEL PUMP AND THE FUEL LINE TO THE CARBURETOR "
1640 PRINT "TO COOL THE VAPORIZED GASOLINE INSIDE."
1650 GOTO 2370
1660 PRINT "OKAY, WHAT WILL BE YOUR NEXT ACTION?"
1670 GOTO 2420
1680 LET X=K[7]
1690 IF X=1 THEN GOTO 1730
1700 IF X=2 THEN GOTO 1750
1710 IF X=3 THEN GOTO 1770
1720 STOP
1730 PRINT "YOU ARE CRANKING THE ENGINE.  IT DOES NOT START."
1740 GOTO 2410
1750 PRINT "EVERYTHING IS DEAD."
1760 GOTO 2410
1770 PRINT "HURRAH, YOUR CAR IS STARTING."
1780 GOTO 2340
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1790 LET X=K[9]
1800 IF X=1 THEN GOTO 1730
1810 IF X=2 THEN GOTO 1750
1820 IF X=3 THEN GOTO 1770
1830 IF X=4 THEN GOTO 1850
1840 STOP
1850 PRINT "YOUR ENGINE IS STARTING--KEEP YOUR FOOT STEADILY ON THE"
1860 PRINT "GAS PEDAL UNTIL THE ENGINE SMOOTHS OUT.  THIS WILL KEEP"
1870 PRINT "THE ENGINE FROM FLOODING.  THEN LET YOUR CAR IDLE AT LEAST"
1880 PRINT "30 SECONDS BEFORE SHIFTING INTO GEAR AND STARTING OFF."
1890 GOTO 2340
1900 LET X=K[10]
1910 IF X=1 THEN GOTO 1950
1920 IF X=2 THEN GOTO 1970
1930 IF X=3 THEN GOTO 1750
1940 STOP
1950 PRINT "YOUR ENGINE DOES NOT START."
1960 GOTO 2370
1970 PRINT "YOUR ENGINE FIRES A FEW TIMES BUT IMMEDIATELY STOPS."
1980 GOTO 2390
1990 PRINT "YOU ARE UNSUCCESSFUL IN STARTING THE CAR THIS WAY."
2000 GOTO 2370
2010 LET X=K[12]
2020 IF X=1 THEN GOTO 2100
2030 IF X=2 THEN GOTO 2060
2040 IF X=3 THEN GOTO 2080
2050 STOP
2060 PRINT "EVERYTHING LOOKS OKAY.  YOUR MOTOR IS STILL WARM."
2070 GOTO 2100
2080 PRINT "EVERYTHING LOOKS OKAY.  YOUR MOTOR IS STILL WARM."
2090 PRINT "THERE IS AN ODOR OF GASOLINE."
2100 GOSUB 0150
2110 IF F=1 THEN GOTO 2340
2120 IF F=0 THEN GOTO 2410
2130 STOP
2140 LET X=K[13]
2150 IF X=1 THEN GOTO 2190
2160 IF X=2 THEN GOTO 2210
2170 IF X=3 THEN GOTO 2250
2180 STOP
2190 PRINT "YOUR CAR DOES NOT START.  WHAT ARE YOU GOING TO DO NEXT?"
2200 GOTO 2420
2210 PRINT "YOUR CAR IS STARTING.  BUT ON YOUR NEXT STOP YOU EXPERIENCE"
2220 PRINT "THE SAME PROBLEM.  YOUR CAR WON'T START.  WHAT ACTION ARE"
2230 PRINT "YOU GOING TO TAKE NOW?"
2240 GOTO 2420
2250 PRINT "YOUR CAR IS STARTING.  BUT THIS ACTION WAS NOT REALLY"
2260 PRINT "NECESSARY.  YOUR BATTERY WAS NOT WEAK--YOUR CARBURETOR"
2270 PRINT "WAS FLOODED.  ALL YOU HAD TO DO WAS TO WAIT A FEW MINUTES"
2280 PRINT "AND THEN USE ACTION 'I'."
2290 GOTO 2340
2300 PRINT "THIS ACTION WASN'T REALLY NECESSARY.  YOU MIGHT WANT TO"
2310 PRINT "STUDY YOUR MANUAL AND PRACTICE TROUBLE SHOOTING ON "
2320 PRINT "ANOTHER PROBLEM SITUATION."
2330 GOTO 2350
2340 PRINT "YOU HAVE COMPLETED THIS PROBLEM SITUATION."
2350 LET F=1
2360 RETURN
2370 PRINT "WHAT WILL BE YOUR NEXT ACTION?"
2380 GOTO 2420
2390 PRINT "WHICH IS GOING TO BE YOUR NEXT ACTION?"
2400 GOTO 2420
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2410 PRINT "WHICH ACTION DO YOU WANT TO TAKE NEXT?"
2420 LET F=0
2430 RETURN
2440 PRINT "IT'S A RAINY SUMMER DAY.  YOU HAVE BEEN DRIVING YOUR"
2450 PRINT "CAR FOR AN HOUR.  YOU STOPPED BRIEFLY AT A STORE AND"
2460 PRINT "NOW YOUR CAR WON'T START.  YOUR CAR IS THREE YEARS OLD,"
2470 PRINT "HAS A WATER-COOLED, SPARK IGNITION ENGINE, AN"
2480 PRINT "AUTOMATIC TRANSMISSION AND AIR CONDITIONING."
2490 PRINT
2500 RETURN
2510 GOSUB 2440
2520 PRINT "THE FOLLOWING IS A LIST OF ACTIONS YOU MIGHT WANT TO TAKE."
2530 PRINT "PRESS <CR> (CARRIAGE RETURN) WHEN YOU ARE READY TO SEE THE L
IST"
2540 INPUT L$
2550 GOSUB 0930
2560 LET U1=0
2570 FOR I=1 TO 7
2580   LET U[I]=0
2590 NEXT I
2600 RANDOMIZE
2610 GOTO 2830
2620 IF U1<7 THEN GOTO 2660
2625 PRINT
2630 PRINT "YOU HAVE EXHAUSTED OUR REPERTOIRE OF PROBLEMS.  WE'RE SORRY"
2640 PRINT "WE DON'T HAVE MORE."
2650 END
2660 PRINT
2670 PRINT "WOULD YOU LIKE TO TRY ANOTHER PROBLEM?"
2680 INPUT M$
2690 IF M$="Y" THEN GOTO 2730
2700 IF M$<>"N" THEN GOTO 2670
2710 PRINT "VERY WELL.  COME AGAIN SOON."
2720 END
2730 PRINT "TYPE 'S' IF YOU WOULD LIKE TO SEE THE START SITUATION AGAIN;
"
2740 PRINT "OTHERWISE A CARRIAGE RETURN."
2750 INPUT M$
2760 IF M$<>"S" THEN GOTO 2780
2770 GOSUB 2440
2780 PRINT "TYPE 'P' IF YOU WISH TO SEE THE LIST OF POSSIBLE ACTIONS AGA
IN;"
2790 PRINT "OTHERWISE, A CARRIAGE RETURN."
2800 INPUT M$
2810 IF M$<>"P" THEN GOTO 2830
2820 GOSUB 0930
2830 LET R=INT(7*RND(0))+1
2840 IF U[R]=1 THEN GOTO 2830
2850 PRINT R
2860 LET U[R]=1
2870 LET U1=U1+1
2880 IF R=1 THEN GOTO 2960
2890 IF R=2 THEN GOTO 3080
2900 IF R=3 THEN GOTO 3230
2910 IF R=4 THEN GOTO 3440
2920 IF R=5 THEN GOTO 3550
2930 IF R=6 THEN GOTO 3670
2940 IF R=7 THEN GOTO 3830
2950 STOP
```

```
2960 REM EMPTY FUEL TANK
2970 FOR I=1 TO 14
2980   LET K[I]=1
2990 NEXT I
3000 LET K[1]=2
3010 LET K[12]=2
3020 FOR I=0 TO 7
3030   LET H[I]=1
3040 NEXT I
3050 GOSUB 1110
3060 IF F=0 THEN GOTO 3050
3070 GOTO 2620
3080 REM CORRODED BATTERY CONNECTORS
3090 FOR I=1 TO 14
3100   LET K[I]=1
3110 NEXT I
3120 LET K[7]=2
3130 LET K[8]=2
3140 LET K[9]=2
3150 LET K[13]=2
3160 FOR I=0 TO 7
3170   LET H[I]=1
3180 NEXT I
3190 LET H[1]=2
3200 GOSUB 1110
3210 IF F=0 THEN GOTO 3200
3220 GOTO 2620
3230 REM FLOODED CARBURETOR
3240 FOR I=1 TO 14
3250   LET K[I]=1
3260 NEXT I
3270 LET K[6]=3
3280 LET K[12]=3
3290 LET K[13]=3
3300 FOR I=0 TO 7
3310   LET H[I]=1
3320 NEXT I
3330 GOSUB 1110
3340 IF F=1 THEN GOTO 2620
3350 IF L$="E" THEN GOTO 3380
3360 IF L$="F" THEN GOTO 3400
3370 GOTO 3330
3380 LET K[9]=4
3390 GOTO 3330
3400 LET K[9]=4
3410 LET K[8]=3
3420 LET K[7]=3
3430 GOTO 3330
```

```
3440 REM WET IGNITION
3450 FOR I=1 TO 14
3460   LET K[I]=1
3470 NEXT I
3480 FOR I=0 TO 7
3490   LET H[I]=1
3500 NEXT I
3510 LET H[2]=2
3520 GOSUB 1110
3530 IF F=1 THEN GOTO 2620
3540 GOTO 3520
3550 REM DIRT IN FUEL SYSTEM
3560 FOR I=1 TO 14
3570   LET K[I]=1
3580 NEXT I
3590 FOR I=0 TO 7
3600   LET H[I]=1
3610 NEXT I
3620 LET H[4]=2
3630 GOSUB 1110
3640 IF F=1 THEN GOTO 2620
3650 GOTO 3630
3670 REM VAPOR LOCK
3680 FOR I=1 TO 14
3690   LET K[I]=1
3700 NEXT I
3710 LET K[6]=2
3720 LET K[12]=3
3730 FOR I=0 TO 7
3740   LET H[I]=1
3750 NEXT I
3760 GOSUB 1110
3770 IF F=1 THEN GOTO 2620
3780 IF L$<>"F" THEN GOTO 3760
3790 LET K[7]=3
3800 LET K[8]=3
3810 LET K[9]=3
3820 GOTO 3760
3830 REM BLOWN FUSE OR OPEN CIRCUIT BREAKER
3840 FOR I=1 TO 14
3850   LET K[I]=1
3860 NEXT I
3870 LET K[7]=2
3880 LET K[8]=2
3890 LET K[9]=2
3900 LET K[13]=2
3910 FOR I=0 TO 7
3920   LET H[I]=1
3930 NEXT I
3940 LET H[6]=2
3950 GOSUB 1110
3960 IF F=1 THEN GOTO 2620
3970 GOTO 3950
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SAMPLE STUDENT INTERACTION

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IT'S A RAINY SUMMER DAY.  YOU HAVE BEEN DRIVING YOUR
CAR FOR AN HOUR.  YOU STOPPED BRIEFLY AT A STORE AND
NOW YOUR CAR WON'T START.  YOUR CAR IS THREE YEARS OLD,
HAS A WATER-COOLED, SPARK IGNITION ENGINE, AN
AUTOMATIC TRANSMISSION AND AIR CONDITIONING.

THE FOLLOWING IS A LIST OF ACTIONS YOUR MIGHT WANT TO
TAKE.
PRESS <CR> (CARRIAGE RETURN) WHEN YOU ARE READY TO SEE THE LIST
 ?

A -- CHECK FUEL GAUGE
B -- CHECK TEMPERATURE GAUGE
C -- CHECK GEAR SELECTOR
D -- TURN OFF RADIO AND LIGHTS, ETC.
E -- WAIT A FEW MINUTES
F -- WAIT 10 OR MORE MINUTES
G -- TURN STARTER KEY
H -- DEPRESS ACCELERATOR HALFWAY AND TURN STARTER KEY
I -- DEPRESS ACCELERATOR ALL THE WAY TO THE FLOOR,
     HOLD IT AND TURN STARTER KEY
J -- PUMP ACCELERATOR AND TURN STARTER KEY
K -- ASK CAR BEHIND YOUR TO GIVE YOU A PUSH
L -- LOOK UNDER THE HOOD
M -- JUMP BATTERY WITH CABLES
N -- HAVE CAR TOWED TO GARAGE


TYPE THE LETTER OF THE ACTION YOU WISH TO TAKE.
TYPE 'P' FOR A LIST OF POSSIBLE ACTIONS.
 ? B
YOUR TEMPERATURE GAUGE IS IN MID-POSITION.
WHICH ACTION DO YOU WANT TO TAKE NEXT?

TYPE THE LETTER OF THE ACTION YOU WISH TO TAKE.
TYPE 'P' FOR A LIST OF POSSIBLE ACTIONS.
 ? C
YOUR GEAR SELECTOR IS IN 'N' (NEUTRAL).
WHICH ACTION DO YOU WANT TO TAKE NEXT?

TYPE THE LETTER OF THE ACTION YOU WISH TO TAKE.
TYPE 'P' FOR A LIST OF POSSIBLE ACTIONS.
 ? A
YOUR FUEL TANK IF HALF FULL.
WHICH ACTION DO YOU WANT TO TAKE NEXT?
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TYPE THE LETTER OF THE ACTION YOU WISH TO TAKE.
TYPE 'P' FOR A LIST OF POSSIBLE ACTIONS.
 ? D
OKAY, THIS RELIEVES THE BATTERY OF EXCESS LOAD.
WHICH ACTION DO YOU WANT TO TAKE NEXT?

TYPE THE LETTER OF THE ACTION YOU WISH TO TAKE.
TYPE 'P' FOR A LIST OF POSSIBLE ACTIONS.
 ? I
YOU ARE CRANKING THE ENGINE.  IT DOES NOT START.
WHICH ACTION DO YOU WANT TO TAKE NEXT?

TYPE THE LETTER OF THE ACTION YOU WISH TO TAKE.
TYPE 'P' FOR A LIST OF POSSIBLE ACTIONS.
 ? L
THE FOLLOWING IS A LIST OF THINGS YOU MIGHT WANT TO DO
UNDER THE HOOD.

0 --- I FINISHED LOOKING UNDER THE HOOD
1 --- I WANT TO CHECK THE BATTERY
2 --- I WANT TO CHECK THE SPARK PLUGS
3 --- I WANT TO CHECK THE FAN BELT
4 --- I WANT TO REMOVE AIR FILTER, COVER CARBURETOR
      WITH MY PALM AND HAVE SOMEONE OPERATE THE STARTER
5 --- I WANT TO CHECK THE OIL
6 --- I WANT TO CHECK THE FUSES AND CIRCUIT BREAKERS
7 --- I WANT TO CHECK THE RADIATOR

TYPE THE NUMBER OF THE ACTION WHICH YOU WISH TO TAKE.
TYPE 'P' FOR A LIST OF POSSIBLE ACTIONS UNDER THE HOOD.
 ? 4
OKAY, YOUR CAR STILL DOESN'T START.

WHICH ACTION DO YOU WISH TO TAKE NEXT?
TYPE 'P' FOR A LIST OF POSSIBLE ACTIONS UNDER THE HOOD.
 ? 6
YOUR FUSES AND CIRCUIT BREAKERS ARE OKAY.

WHICH ACTION DO YOU WISH TO TAKE NEXT?
TYPE 'P' FOR A LIST OF POSSIBLE ACTIONS UNDER THE HOOD.
 ? 1
THE BATTERY WATER LEVEL IS OKAY.  BATTERY CABLES ARE TIGHT
AND NOT CORRODED.

WHICH ACTION DO YOU WISH TO TAKE NEXT?
TYPE 'P' FOR A LIST OF POSSIBLE ACTIONS UNDER THE HOOD.
 ? 2
YOUR SPARK PLUGS ARE OKAY.  YOU JUST CHANGED THEM THREE WEEKS
AGO.  THE CONNECTOR CABLES ARE TIGHT.
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```
WHICH ACTION DO YOU WISH TO TAKE NEXT?
TYPE 'P' FOR A LIST OF POSSIBLE ACTIONS UNDER THE HOOD.
 ? 7
THE RADIATOR IS OKAY.

WHAT'S YOUR NEXT ACTION?
TYPE 'P' FOR A LIST OF POSSIBLE ACTIONS UNDER THE HOOD.
 ? 3
YOUR FAN BELT IS OKAY.

WHICH ACTION DO YOU WISH TO TAKE NEXT?
TYPE 'P' FOR A LIST OF POSSIBLE ACTIONS UNDER THE HOOD.
 ? 5
YOUR OIL IS OKAY.

WHAT'S YOUR NEXT ACTION?
TYPE 'P' FOR A LIST OF POSSIBLE ACTIONS UNDER THE HOOD.
 ? 0
YOU FINISHED LOOKING UNDER THE HOOD.
WHICH ACTION DO YOU WANT TO TAKE NEXT?

TYPE THE LETTER OF THE ACTION YOU WISH TO TAKE.
TYPE 'P' FOR A LIST OF POSSIBLE ACTIONS.
 ? M
YOUR CAR IS STARTING.  BUT THIS ACTION WAS NOT REALLY
NECESSARY.  YOUR BATTERY WAS NOT WEAK--YOUR CARBURETOR
WAS FLOODED.  ALL YOU HAD TO DO WAS TO WAIT A FEW MINUTES
AND THEN USE ACTION 'I'.
YOU HAVE COMPLETED THIS PROBLEM SITUATION.
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COMPUTER-BASED EDUCATION COURSES

AEROSPACE ENGINEERING

Aircraft Design—Drs. W. T. Fowler and D. G. Hull
Structural Analysis—Dr. Eric Becker

ARCHITECTURE

Survey of Environmental Control Systems—Dr. F. N. Arumi

CHEMICAL ENGINEERING

Process Analysis and Simulation—Dr. D. M. Himmelblau
Optimal Control—Drs. T. F. Edgar, E. H. Wissler and J. O. Hougen

CHEMISTRY

Vector Space Theory of Matter—Dr. F. A. Matsen
Physical Chemistry Laboratory—Dr. John M. White
Organic Chemistry—Drs. J. C. Gilbert and G. H. Culp
Introductory Chemistry—Dr. J. J. Lagowski
Principles of Chemistry—Dr. J. J. Lagowski
Introduction to Chemical Practice—Dr. J. J. Lagowski

CIVIL ENGINEERING

Computer Methods for Civil Engineering Laboratory—Dr. C. Philip Johnson et. al.

ECONOMICS

Theory of Income and Employment—Dr. James L. Weatherby

ENGLISH

English Composition—Dr. Susan Wittig

HOME ECONOMICS

Child Development—Dr. Mary Ellen Durrett

LINGUISTICS

Language and Society—Dr. W. P. Lehmann

MATHEMATICS

Calculus I, II—Dr. John P. Alexander

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Dynamic Systems-Synthesis—Dr. L. L. Hoberock
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